A Guide to the Freshwater Mussels of Nebraska

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Collection of Mapleleaf and Pimpleback, Shell Creek, Platte County, Photo courtesy of Kelly Turek, University of Nebraska-Lincoln

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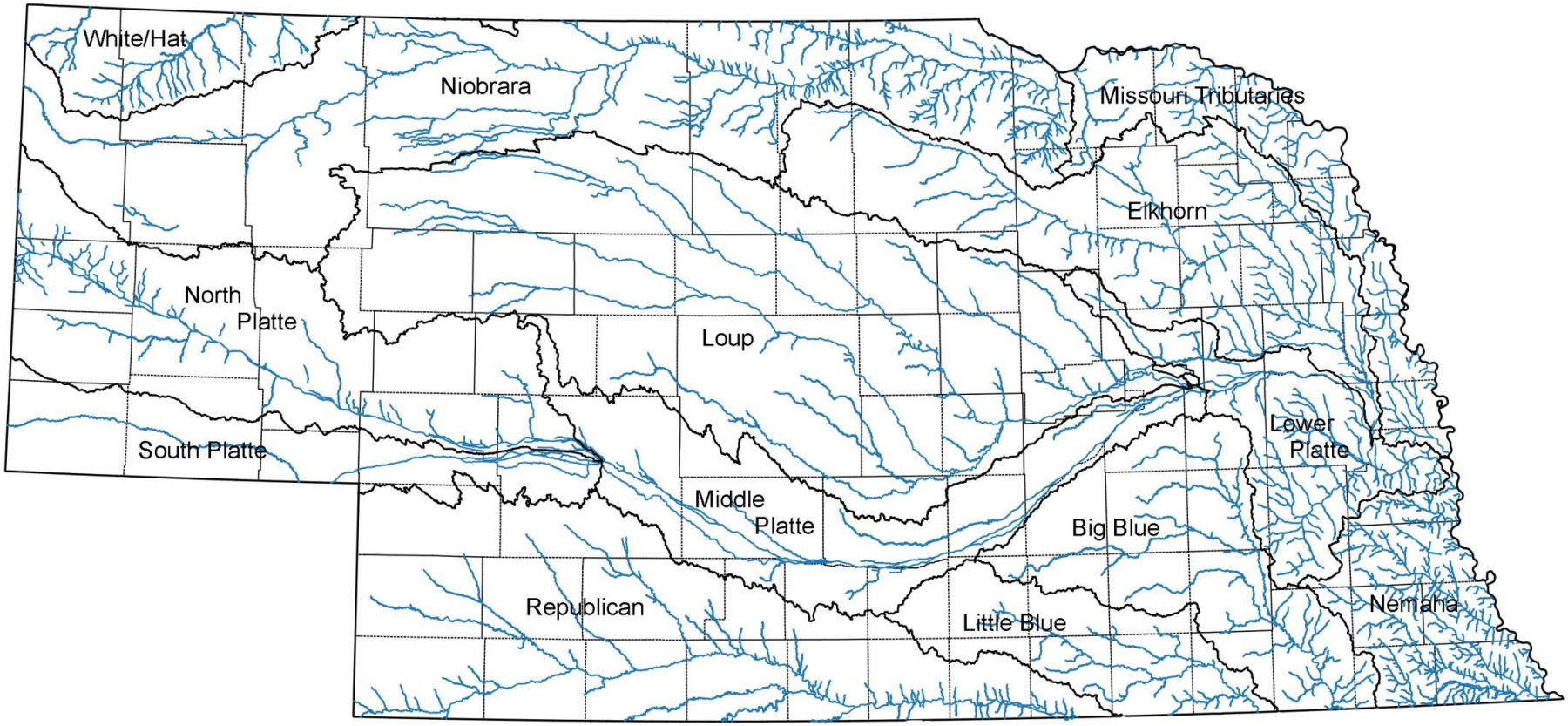

Nebraska's River Basins

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INTRODUCTION

These freshwater mollusks with paired, opposing valves have been called mussels, clams, bivalves, unionids, pearly mussels or naiads. Technically, the terms "clam" or "mussel" refer to marine (salt-water) organisms. Our freshwater forms differ from marine forms in their reproduction which involves a parasitic larvae and a fish host. However, "freshwater mussel" has been in use for so long that this is now a generally accepted name and no amount of whining by malacologists is likely to change that.

Charismatic megafauna is a term that was coined to describe animals with big brown eyes and soft fur that inspire conservation campaigns, fundraising drives and TV shows. But you have never seen a freshwater mussel as the poster child of a wildlife fundraising drive. They lie buried in the bottom of a stream, filtering the water for their livelihood. What little portion of their body left exposed is often covered in a mat of algae giving them a striking resemblance to a rock . . . a living rock. Hardly something to inspire a big "awwwww".

Yet, if you were to pick up a fresh mussellshell and cleaned it, you would have something that was remarkably attractive, almost jewel-like. A glossy shell with intense colors and, perhaps, brightly colored stripes. It may be perfectly smooth or covered in ridges, grooves and bumps. The insides of the shells are iridescent whites, pinks and purples. Their names may be descriptive or imaginative but are certainly not boring. Pink heelsplitter, Threeridge, Hickorynut, Wabash pigtoe, Lilliput, Fatmucket, Paper pondshell, and Giant floater to name a few. But these same freshwater mussels are among our most imperiled fauna. Of some 300 species in North America, 72% are considered to be endangered, threatened or of special concern. Only 24% are still listed as stable.[53]

The Importance of Freshwater Mussels

The value of freshwater mussels, indeed of any organism or resource, is in the eye of the beholder. Some look at a mountain and see beauty, another might sees an obstacle to travel, and yet others see it as a source of minerals. Ditto with freshwater mussels. Some are fascinated by their shells, others are comfortable simply knowing that this native critter is around, while most simply don't care. On the whole, the role of freshwater mussels has been little studied.

The Economic Value of Freshwater Mussels

Prior to the European colonization of North America, American Indians used them as food, as tools (spoons, cups, digging tools), and as ornaments. In the early 1900's, there was a short-lived industry in harvesting them for making buttons, for decorative inlays, and for their pearls. Today they are being used to make seed pearls for the cultured pearl industry.

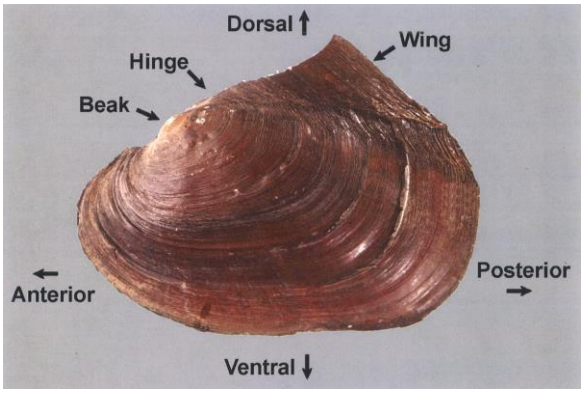
Their Role in the Environment

Freshwater mussels serve as living filters, straining bacteria, phytoplankton and particulate organic matter from the water. After passing through their digestive tract, this material is deposited onto the substrate as feces. This is food for other macroinvertebrates which, in turn, are food for fishes. Periphyton and algae grow on their shells which is habitat for aquatic macroinvertebrates. The burrowing and movement of mussels through the sediments remixes substrates, stabilizing them and releases organic matter to the water column. Freshwater mussels, themselves, are food for fishes like freshwater drum as well as mammals like muskrats and raccoons. [26, 45, 48, 49]

Because they are long-lived and can't move very far, they also serve as indicators of water quality. They are dependent on their environment for long-term health in a way most organisms are not because, if things get bad, they can't pick up and move somewhere else. It's simple: Abundant, healthy mussels = water quality is (and has been) good. Dead mussels = water quality is (or has been) bad.

Shell Anatomy

Freshwater mussels are bivalves which means they have two opposing valves. These valves are connected on the dorsal edge with a hinge composed of a **ligament** which holds the valves together and **hinge teeth** which keep the valves aligned. There are two sets of teeth, the **pseudocardinals** and the **laterals**. Between these two sets of teeth is the **umbo** or **beak**. When viewed from the side and imagining a vertical line through the beak, mussel

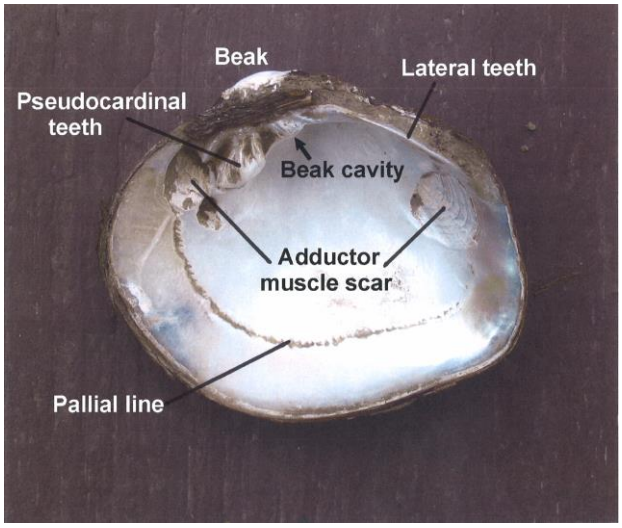


shells appear lopsided. The short end is anterior and the long end is posterior.

"Pseudocardinal" means "false" cardinal. So, if these are "false" cardinal teeth, then what are "true" cardinal teeth? Many marine mussels (and some freshwater mussels such as the Asian clam) are symmetrical and at the beak position there are a set of true cardinal teeth. Flanking the cardinal teeth on both sides are two sets of lateral teeth. Freshwater mussels have only one set of lateral teeth and, what should be the cardinal teeth, are set over on the side. Since they aren't the topmost, they have been called "false" cardinal or pseudocardinal. These pseudocardinals are a set of short, blunt teeth on the anterior end of the beak. On the other or posterior side are a set of long-thin ridges which are the lateral teeth. In most species, there will be two lateral teeth in one valve and one lateral tooth in the other valve.

On the surface of the beak will often be a series of raised ridges which form a series of lines or loops that are unique to each species and are important in their identification. These ridges, if present, are called the **beak sculpture.**

The core of a mussel shell is composed of calcium carbonate extracted from the water. The mussel grows by the addition of material on the edge and on the interior surface of the shell by the **mantle**. The mantle lines the interior of the shell, wrapping around the internal organs and is attached to the shell at the **pallial line**. The exterior of the shell is protected by a layer of tissue called the



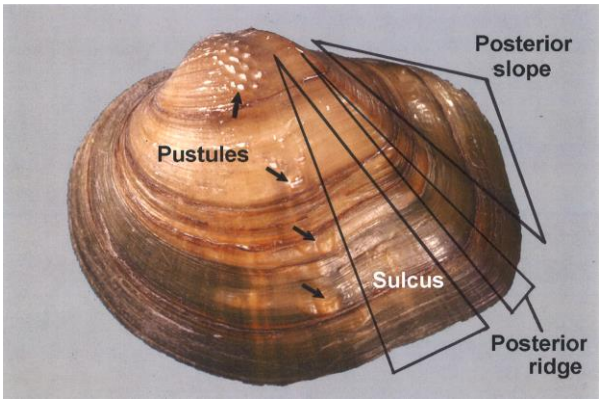
periostracum. This protects the core from abrasion and from being dissolved by acidic water. The exterior is often marked with concentric rings. These represent periods when growth has stopped (such as in winter) and are usually interpreted as annual growth rings. But growth can stop and rings may form during periods of stress such as drought or a physical disturbance.

The interior of the shell is covered by a dense layer of calcium carbonate called the **nacre** or mother-of-pearl. The color of the nacre can vary from white to pink to deep purple and is often iridescent. At the position of the beak there is a **beak cavity** which can be deep or shallow and can help identification. At each end of the mussel shell will be circular scars which show where the **anterior** and **posterior adductor muscles** were

attached. These mussels close the shell when needed.

The exterior of the mussel's shell may be smooth or may have bumps, pustules or ridges which are useful in shell identification. The anterior end of the shell is generally smooth and rounded. In most species, the posterior end of the shell will have a **posterior ridge** running diagonally from the umbo to the ventral edge. This ridge may be quite sharp or so smoothly rounded that it is barely noticeable. Anterior to the posterior ridge may be a groove called a **sulcus**. Posterior to the posterior ridge is a **posterior slope** which may also have pustules or ridges. In some species the posterior slope extends dorsally into a large structure called a **wing**. A few species also have a small wing anterior to the beak.

The internal anatomy includes the organs typical of any aquatic animal.



These include a stomach and digestive tract, heart, kidneys, liver, gills and reproductive organs. Unique to mussels are the two siphons that extend out of the posterior end. One is the **incurrent siphon** that sucks water and food into the valves. The other is the **excurrent siphon** that expels water and wastes. At the anterior end is the **foot**, a large muscle that can be extended and is used to move and to bury the mussel into the substrate.

LIFE HISTORY

While freshwater mussels do have a foot and are able to move, their ability to move is limited to little more than a few dozen feet in their lifetimes. Most spend their entire lives in one location with their anterior end buried in the substrate. Their immobility creates special challenges for reproduction.

Food and feeding

Freshwater mussels feed by pumping water over their gills where they filter microorganisms out. Recent research has shown that there are also water currents within the mantle cavity which can pull algae from the substrate through the valve edges and pass them into the stomach.[37] Excretion of waste products also occurs via the siphons and the valve edges.

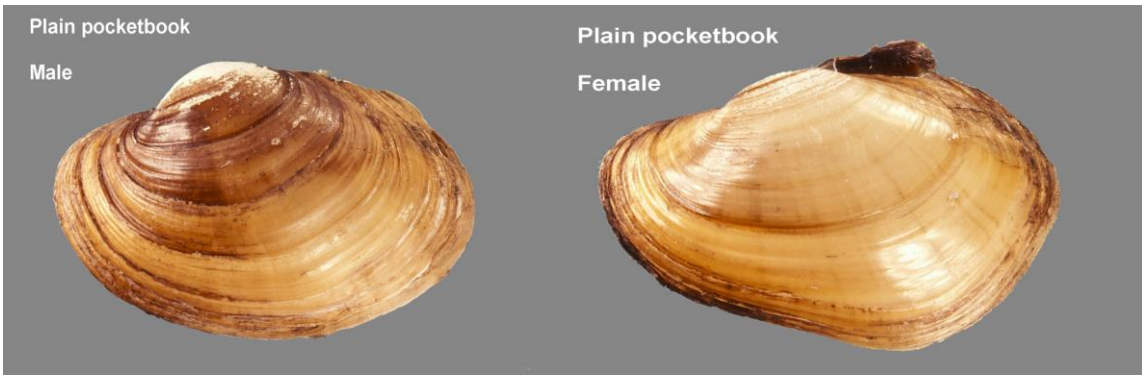
Reproduction

Most freshwater mussels are either male or female. The male produces sperm that he expels into the waterbody through the excurrent siphon. A female filters this sperm out of the water and uses it to fertilize her eggs. The fertilized eggs develop into a larval form called glochidea which are parasitic on fish. The ways that freshwater mussels can trick fish into range for the glochidea to attach are as many as there are mussel species.

Now think about this for a minute. Most freshwater mussels live in flowing waters. While a few species can live in lakes or reservoirs, that is not where they evolved and it is not their preferred habitat. Buried in the bed of a flowing stream, the male releases its sperm. This sperm flows downstream with the current until it is picked up by a female. Now, if the female only released fertilized eggs or baby mussels, they would float some distance downstream before they could settle onto the stream bottom. In the long term, with this constant downstream movement, all of our freshwater mussels would end up in the ocean. Their survival depends on having some means of getting their progeny back upstream.

Here is where those parasitic glochidia factor in. These are released into the water where they clamp onto the gills or fins of a suitable fish host. While not harmful to the fish, these glochidia will encyst within the fish's tissues and there develop into a juvenile mussel. After a few weeks, these juveniles drop off and bury themselves in the substrate where, if the habitat is favorable, they can now develop into adults and repeat the cycle. It is during those few weeks of parasitism that the fish has a chance to move upstream where the juveniles can recolonize upstream habitats. It is in this manner that freshwater mussels can sustain their populations in a watershed or colonize new watersheds.

There appear to be a few species that are, or can be, hermaphroditic (both sexes). The literature indicates that three species found in Nebraska, the Paper pondshell, the Lilliput and the Creek heelsplitter, may be hermaphroditic. It has also been observed that in areas where mussel densities are very low, any species can self-fertilize.



We do know that the glochidia will not attach and transform on just any fish. Each species of mussel has a particular fish species or group of species that it can use. [A few mussels can use amphibians to accomplish this.] Work on identifying these fish hosts began in the early 1900's and we still do not know all of the potential hosts for all of the mussels. We do know that some freshwater mussels can use several fishes as hosts (generalists) and others only a few (specialists). This host specificity is an important factor in their reproduction (see Threats below).

Several species show distinct differences in shell shape between males and females. In these, the posterior end of the female shell will be much expanded such can be seen in the photos of the Plain pocketbook shown here.

Growth

Growth rates of freshwater mussels depend on many factors including species, water quality, food, environmental impacts, etc. The Lilliput, for instance, has a maximum size of 4 cm whereas a Giant floater can exceed 24 cm. Comparing their growth would be nonsense.

Maybe the only generalization that works is that juveniles grow faster and growth slows as they age. Some early work (and some of the best work) on mussels was done at the Fairport Station on the Mississippi River in the early 1900's.[6] They found that thin-shelled species grew faster than thick-shelled species. Plain pocketbooks, a medium-shelled species, reared in ponds reached 6.5 cm in three growing seasons. Giant floaters, a thin-shelled species, reached 6.6 to 8.8 cm in only 16 months.

Age and Longevity

Simply figuring out how long freshwater mussels can live has been a major stumbling block. It had been assumed that the rings observed on the shell's exterior were annual growth rings. But we have found this to be partly false. Marked individuals that were periodically retrieved, measured and aged found that the rings consistently underestimated age. Cases of negative growth were actually observed. Ages from shell rings were consistently underestimated and that individuals in some populations could be over 100 years old.[2, 34] It has also been found that handling, especially repeated handling, reduced growth and further biased age estimates.[14, 15] The only consistently accurate method of aging freshwater mussels was by thin cross-sections of the shell.[15, 34]

The points to note are that 1) mussels are very sensitive to handling and because of this, 2) freshwater mussel mark/recapture studies for age and growth are probably biased, and 3) external shell rings cannot be used to age mussels, which means that mussels may be considerably older than previously suspected. What is the significance? Many mussel populations are composed of very old individuals and they have a very low rate of recruitment. ["Recruitment" is the number of juveniles that actually survive to adulthood.] This means that impacts, like commercial harvest or a pollution event, will have long-lasting negative consequences.

THREATS

Threats. . . . just where do we start? Habitat alteration, siltation, drought and dewatering, chemical and organic pollutants, overharvest, physical damage, and exotic species. Mussels are sedentary organisms that cannot escape environmental threats. Furthermore, many are long-lived so that low-level chronic threats can take years to impact populations. They have low reproductive rates so their ability to recover these impacts is limited. Let's discuss these in turn.

Impoundments

While there are a variety of threats to freshwater mussels, the greatest has been habitat alteration. These animals evolved in streams, are immobile and depend on the mobility of fishes for their overall survival. Streams have a wide diversity of habitats including pools, riffles, runs, glides, rapids, and off-channel meanders. The negative impacts of impoundments on freshwater mussel faunas have been well-documented.

For instance, the mussels in the Tennessee River declined from 100 to 44 species after dam construction. On the Neosho River in Kansas, there were significantly fewer species in the impounded area behind lowhead dams than in the river upstream. Those species that survived were silt-tolerant while sensitive species had disappeared.[7, 28, 36, 46, 52]

The first impact will be on the mussels that may have been living in the bed of the stream that was impounded. As it fills, the streambed becomes the deepest part of the impoundment and silt accumulates. Sediment accumulation of as little as 1 inch can kill upwards of 90% of freshwater mussels.[8] Growth is reduced as these deeper waters are colder and there is no flow to bring food. Reproduction is impacted as the impoundment will be stocked with fishes that are not the natural hosts for most native mussels. While some might argue that a pool in a stream is similar to the quiet waters of an impoundment, they would be wrong. An impounded lake begins shallow and gets increasingly deeper as it approaches the dam. Pools in streams begin shallow, get deeper and then shallow up again. They are connected to riffles or rapids or glides and there is flowing water with a variety of substrates.

A second impact of impoundments is the alteration of the stream habitat downstream. Impoundments are built to control the flow of a stream for various reasons including flood control, power, and irrigation. The stream below the dam may experience low flows or fluctuating flows. At the impoundment will act as a sediment trap, the released water will be hungry for sediment and will result in streambed degradation. Water released through the dam is often cold hypolimnetic water that lacks the food resources needed by mussels.

Another impact is the fragmentation of the stream. It was noted above that freshwater mussels depend on fishes to carry their young back upstream to maintain their populations. Many of these fishes are migratory and the dam stops their migrations. As a consequence, some host fishes either cannot move upstream to repopulate the stream or they cannot even get to the mussels to be infected with their glochidea.[51] I have observed that the Fragile papershell is common in the Big and Little Blue Rivers below the Blue Springs and Fairbury dams. This species uses the Freshwater drum (*Aplodinotus grunniens*) as a host that is found in these rivers. However, the Fragile papershell is virtually absent above these dams. It would appear that these dams have served as a barrier to the distribution of the Fragile papershell in the Blue River system.

Siltation

Excess sediment will have an impact on freshwater mussels which is often species dependent. Some species like the Giant floater and Mapleleaf were tolerant whereas others like the Wabash pigtoe or Black sandshell were not. The first two are doing quite well in Nebraska while the later two may be extirpated. Iowa mussel populations declined with loss of streamside woodlands, high siltation, and intensive agricultural land use.

Removal of forest vegetation increases stream runoff. Increased runoff can activate the stream bed and results in increased scour and altered deposition of sediment. Streambeds degrading in one area with aggrade in another downstream. Aggradation results in increased width/depth ratios and increased bedload transport. In the end, habitat complexity declines.[17, 32, 40]

Stream Channelization

Streams naturally adjust to natural variations in flow and, over time, develop a quasi-equilibrium. Channelization destroys this equilibrium by reducing stream length and increasing gradient. As a result the stream will degrade, eroding downwards and outwards, eliminating meanders, filling pools and burying riffles while also removing riparian vegetation and snags. It reduces the total stream area and eliminates the natural diversity of a stream's flow and substrate. Channelization also results in lower low flows and higher high flows. In a comparison of channelized and unchannelized streams in Iowa, the unchannelized streams had more diversity of habitat and supported more centrarchids and ictalurids. The result is the direct loss of mussels during the channelization process and the loss of the hosts needed for reproduction and the loss of the habitats needed for recovery. This is especially notable in Nebraska's Nemaha River basin where many species of mussels have been extirpated due to the extensive channelization of the basin's streams.[11, 27, 42, 44]

Pollutants, Pesticides and Contaminants

Freshwater mussels are more sensitive to pesticides than many other animals. The effects of pesticides are species-specific but, in general, sub-lethal levels inhibit respiratory efficiency and accumulate in the tissues. Mussels, especially juveniles, are sensitive to heavy metals. River reaches downstream of wastewater treatment plants are often devoid of freshwater mussels as their

glochidia are very sensitive to ammonia.[12, 30, 52]

Predation

Let us not forget that, for some animals, a freshwater mussel is a tasty meal. It is not uncommon to find shell that has been collected by some predator, cracked open and eaten. There may only be one or two or there may be dozens heaped into a pile called a "midden" .

A pile of mussel shell found on banks of Big Blue River, Gage County

Drought and dewatering

It would seem to be rather intuitive that a relatively immobile species would experience heavy mortality by dewatering (Duh!). But the impacts depend on whether this is a total dewatering or low flows (or low water levels). In streams, a totally dry stream means almost total mortality. This is the primary impact. But there are secondary impacts to low flows which are mainly due to low oxygen levels and high temperatures. As long as there is some flowing water, these secondary impacts appear to be minimal. But when flow ceases, there may be heavy mortality even if the stream is not totally dry. In regulated rivers that routinely experience extremely low flows, the impacts are due to high biological oxygen demand and high temperatures. If the low flows affect only short sections of stream, recovery will depend on whether barriers exist to prevent re-colonization.[16]

I have walked the beds of several impoundments that have been drained and have found that there will be no mussels in the deepest portions of these impoundments. It has also been my experience that you will seldom find mussels in the fluctuation zone. In the flood control reservoirs, the annual fluctuation is low, maybe a foot or so. In irrigation reservoirs this zone can be dozens of feet. In any case, you seldom find mussels in this zone except for juveniles. (Juveniles drop off of fish in shallow waters in early summer, only to get stranded later in the year. This is most noticeable in irrigation reservoirs that are drained every fall.) The greatest numbers of mussels will be found in the 6' to 10' of lake bottom just below this zone. Any fluctuation greater than normal (like draining for "rehabilitation") will cause 100% mortality.

Overharvest

In the early 1900's, freshwater mussels experienced heavy commercial pressure for the button industry which tapered off after plastics were invented. The thicker shelled mussels were harvested and drilled for button blanks like that in the photo at the right. More recently, the cultured pearl industry has created great demand. The shells are drilled out and the blanks made into seed pearls which are inserted into oysters. Apparently, the best seed comes from freshwater mussels. The problem is that it takes decades to grow mussels large enough to make buttons or seed pearls. Couple this with their low reproductive rates, they are easy to overharvest.

Remains of Threeridge that has been cut for buttons, collected from banks of Mississippi River in Moline, IL

Physical Damage

When we are talking about physical damage, we mean damage like that shown in these photos. The most common cause of this may be trampling by livestock. Livestock pastured on bottomlands and the riparian zones of streams often walk in the streams for watering and for cooling off in summer. It has been my observation that when there are obvious signs of overgrazing or trampling of a streambed, that no mussels will be found.

Another form of "trampling" is the practice of running up and down streambeds in ATV's and four-wheel drive vehicles. This has been observed on most any stream where there is easy access, especially during the low-flows of late summer.

Pink heelsplitters that were severely damaged and lived for several more years

Exotic species

It is now well-known that the exotic Zebra mussel has had some serious impacts on mussels in the upper Midwest. They do this by attaching directly to the mussel's shell and restricting the opening and closing of the shell. On the other hand, the Asian clam seems to have had minimal impact on our native mussels (though they have serious impacts on things like power plants).

NEBRASKA'S FRESHWATER MUSSEL FAUNA

The shell of 30 species of freshwater mussels have been collected from within the boundaries of the state of Nebraska. Of these, five species were always incredibly rare and are extirpated or nearly so (Mucket, Rock pocket-book, Hickorynut, Bleufer, Creek heelsplitter). That leaves 25 species and of these, four more may be extirpated because, while live or fresh specimens may have been found in recent years, we cannot find live ones now (Higgins eye, Scaleshell, Fatmucket, Pistolgrip). That brings us to 21 species. Of these, four species were historically common but are now believed to be extirpated (Wabash pigtoe, Black sandshell, Pondmussel, Fawnsfoot). That drops us to 17 species. Of these, five once-common species can now be found alive in only one or two streams (Threeridge, Plain pocketbook, Yellow sandshell, Pimpleback, Creeper). That leaves us with 12 (out of 30) species that may still be doing ok.

Can You Eat Them?

This is a question that I get at least once a year. Since I have never eaten one and have no intention of ever doing so, I cannot answer that question directly. The short answer is "Yes, but. . . ." and I always ask the party to call me back if they do try them to give me a report on how they were. No one has ever called back.

The first thought that I have is "Why would you want to?" Here is an animal that is living in waterbodies that often have high levels of pesticides and livestock waste. Many fresh-water mussels are long-lived, slow growing and feed at the bottom of the food chain so they have a long time to accumulate toxins in their tissues. But, I have talked with people that have cooked and eaten freshwater mussels. Generally, their comments are that they have no flavor and are really, really chewy.

There is one interesting and entertaining historical account that summarizes what I have heard. The

account is in a book entitled "Co. Aytch" written by Sam R. Watkins in 1881 (The book is in the public domain and can also be found online).[50] Sam Watkins was a member of the Maury Grays of the First Tennessee Regiment in the Civil War (1861-1865). Here is what he had to say:

"EATING MUSSELS

Reader, did you ever eat a mussel? Well, we did, at Shelbyville. We were camped right upon the bank of Duck river, and one day Fred Dornin, Ed Voss, Andy Wilson and I went in the river mussel hunting. Every one of us had a meal sack. We would feel down with our feet until we felt a mussel and then dive for it. We soon filled our sacks with mussels in their shells. When we got to camp we cracked the shells and took out the mussels. We tried frying them, but the longer they fried the tougher they got. They were a little too large to swallow whole. Then we stewed them, and after a while we boiled them, and then we baked them, but every flank movement we would make on those mussels the more invulnerable they would get. We tried cutting them up with a hatchet, but they were so slick and tough the hatchet would not cut them. Well, we cooked them, and buttered them, and salted them, and peppered them, and battered them. They looked good, and smelt good, and tasted good; at least the fixings we put on them did, and we ate the mussels. I went to sleep that night. I dreamed that my stomach was four grindstones, and that they turned in four directions, according to the four corners of the earth. I awoke to hear four men yell out, "O, save, O, save me from eating any more mussels!"

Collecting Freshwater Mussels

The easiest and most common way to collect shell is to walk the shoreline of a stream or lake, picking up shell as you go. You can also wade while feeling with your feet or, if the water is shallow, you can use your hands. If you feel something that might be a mussel, you reach down and pick it up to see what you have. You might try an underwater viewer such as a bucket with a clear plastic bottom or a commercial viewer. I should note that I have not had much success with these viewers as our streams tend to be too turbid to see much. You might also use a mask and snorkel to look for mussels or, if you are SCUBA certified, you can do that.

As a rule, I do not collect live mussels but prefer to photograph them and return them to the water. This is especially true if I have already collected dead shell of the same species at that site. Unless you are planning on cooking them (see "Can you eat them?" above), mussels would have to be preserved. This requires a large wide-mouth container, lots of preservative and someplace to store

them. Dead shell are much easier to store as they can be kept in a box or bag.

If you do collect some freshwater musselshells, it is important that you record where and when you found them. To a museum, a specimen without collection information is of little or no interest.

Identification of Freshwater Mussels

Hands down, the best way to learn how to identify freshwater mussels is to accompany someone who knows them. Having the shell in hand while someone points out how to identify them is invaluable. The next best way is to take your collection to an expert and have them help you out.

This guide does not include an identification key. Freshwater mussel keys are notoriously error-prone. Species' shells can vary in size, shape, color and thickness which often lead one astray when using a key. Instead, you can compare your shell to the illustrations and the descriptions to make a best guess as to what you have. I also recommend that you obtain books and guides from other states. I have several and use all of them when working with a difficult shell or something that I haven't seen before. Also, these will also have species that are not found in this guide so that, if you have something new, these may help you identify it.

There is some terminology that may be useful when reading the descriptions or using a key. Most of these are covered in the Anatomy section but here are two others. "Inflated" and "Compressed". These refer to how "fat" the shell is. A "compressed" shell is fairly flat keeping in mind that there still has to be room inside for the mussel's internal organs. An "inflated" shell is fatter than a "compressed" shell. Imagine putting a straw into the shell and pumping air in like a balloon, causing the shell to "inflate". This is "inflated".

Plasticity

A complication in identification is that the shape of freshwater mussels can vary with their environment. The changes in shell shape are not willy-nilly but tend to follow a definite pattern that can be observed when moving from small headwater streams downstream into large rivers. This observation led Dr. Arnold Ortmann to develop what is now known as "Ortmann's Law".[3, 38] He said:

"While studying the Naiad-shells of the upper Ohio-drainage, the fact was forced upon my mind, that certain species which inhabit headwaters and smaller streams are represented, in the larger streams, by different, but very similar forms, which are distinguished from them chiefly by one character, namely obesity. The headwater-forms are rather compressed or flat, the large-river-forms more convex and swollen. I also found that in the rivers of medium size intergrades between the extremes are actually present."

Often termed "Plasticity", this variability in shell shape led to each different form or shape being described and named as a new species. For instance, there are almost 80 different synonyms for the Eastern elliptio (*Elliptio complanata).*[29] The same thing was noted for the work done by Samuel Aughey in Nebraska in 1877 where he reported 83 taxa for Nebraska. Since then, 25 have since been combined and only 31 of the remaining 58 may have been accurately identified.[23]

Well, so what?

Well, please keep in mind that the shell you have in your hand may not exactly match the photos in a guidebook. I have observed this in Nebraska with the variability in the shells of the Giant floater. In the Salt Valley lakes around Lincoln, they are quite thin, glossy and a dark greenish brown. A little to the west, in the Big Blue River, the shells are thicker with a rough, brown/black exterior. Out west, in the southwest irrigation reservoirs, they have a moderately thick shell that is a glossy light tan with dark rings. So. . . look for the key identification characters and eliminate those that don't match. Then compare what is left and see if one fits.

The Species Accounts

The species accounts include a page summarizing biological information and a page of photographs A distribution map is included in the map section at the end of this guide.

Photographs

The photopage will attempt to include photos of an adult with exterior, interior and side views, a juvenile and an enlargement showing the beak sculpture. For most species I also cut a shell in half the long way and included a photo of this cross-section. The photographs illustrate the typical condition of shell found in Nebraska. That can vary from pristine to relict condition. For several species, live or fresh dead shell have never been

found in this state. If only dead or relict shell have been found, that is what is shown. In some cases, where even relict shell are hard to find, I was able to obtain or borrow shell from other states and photograph those to illustrate what they should look like. For two species, the Scaleshell and the Creek heelsplitter, I was not able to obtain specimens but was able to obtain photos from Dr. Kevin Cummings at the Illinois Natural History Survey.

One important characteristic that is used to identify species is the beak sculpture. During their first year of life, many species of freshwater mussel develop distinct and prominent sculpturing on the shell's beak taking the form of loops, bars or ridges. Most ID guides attempt to use text to describe these. I have a real problem with these and think that a photograph is worth a thousand words. I have attempted to provide a decent photograph of the beak sculpture of each species to go along with the description.

In the field, I have often noted how a shell feels in the hand goes a long way towards identification. Some shells of different species look quite a bit alike in photographs but, when held in the hand, are noticeably different. Now, I cannot place any shells in your hand but I have attempted an alternative method. I have taken a typical shell and cut it lengthwise, flattened the cut edge with emery cloth and photographed the cross section view. In some cases, the cut edge was painted white to increase the visibility of the shell edge. In this way I hope to be able to show shell thickness and how this varies as well as differences in the shell curvature (inflated or compressed).

Biological information

Description: I do not provide complete descriptions of the shells. Many features such as a rounded anterior end or the lateral teeth are common to most of our mussels and of limited use in identification. Instead, I address those features that are helpful to identifying that particular mussel from the time you first pick it up.

Similar species: Here are some species that look a lot like the mussel being described. This includes some pointers on how to separate them.

Conservation status: There are three levels of status listed. Global (G), national (N) and state (S). The G, N, or S are then followed by a number showing the level of concern with 5 being good and 1 being endangered. The state level (S) is sometimes followed by a letter. These are H for Historical (probably extirpated from state but not sure), X for Extirpated (Extinct in state) and NR for Not ranked (not enough data at this time).

Hosts: This is a listing of known or probably reproductive hosts for this species glochidea.

Habitats used: The habitats that this species is reported to use in other states. These may or may not be relevant to Nebraska but may give clues on where to look for them.

Distribution: This is a brief description of this species range in North America.

Collection notes: Here are comments about where we have found this species in Nebraska.

Comments: Here are miscellaneous comments that may be of interest regarding this species.

Nomenclature

Each species has two names, the scientific name and the common name. The scientific name is the name, derived from the Latin or Greek, which identifies a species to the scientific community. This is useful as it describes where the critter fits within the big picture of life on the planet and allows people who speak different languages to know what you are talking about. These names are not fixed but, rather, are under constant review and may be changed as new evidence appears. The scientific names used in this document come from two online sources. One is MolluscaBase [http://www.molluscabase.org], a worldwide effort to organize the names of mollusks.[33] The other is the Mussel Project Website or MUSSELp [http://mussel-project.net].[13]

The common name is a name that is in "common" use. Names that were applied to organisms so that people could tell each other what they had. In the case of freshwater mussels, most of these names were apparently created by commercial mussel harvesters in the 1800's. To them, the difference between a Giant floater and a Threeridge was important. The common names used here come out of "Names of Mollusks, Second Edition".[47]

The Maps

Mussel shell is often rated as to overall condition when collected. This is an indicator of the status of the species in a waterbody. "Live" means the animal closes it's valves and squirts water when picked up as in the photo at right. "Fresh dead" means shells are in very good condition *and* still retain bits of tissue on the inside. In the maps, Live and Fresh Dead are combined.

Live Mapleleaf, Big Blue River; note stream of water squirting out of the mussel.

"Dead" indicates the shell is in good condition but no tissue remains. The exterior of the shell is in nice shape with a bright, shiny interior and the valves will usually be connected. At the left is a dead shell that has been separated for photographing.

"Weathered dead" shell show wear and age. The exterior may be worn and missing some epidermis. The nacre is dull or discolored and a

Mapleleaf in relict condition

thumb rubbed across the inside of the shell comes away white. The teeth will start to show wear and you often find single valves. "Chalky" is a heavily worn shell similar to that shown at the right. The exterior will be missing most of its epidermis. The teeth are worn and valves are rarely found together. Shell will often be found as broken fragments and the older it is, the more likely you will find only fragments. If only Weathered dead and Chalky shell can be found at a site, it is assumed that the species has disappeared from that area.

Mapleleaf, dead shell in very good condition but no tissue remaining

Rock pocket-book from archeological dig in Sarpy County

It is common, when visiting a site, to find mussel shells in all of the stages mentioned above. When mapping the results of a single field collection, only the best condition shell is mapped. So, if you see an orange dot, you know that live or fresh dead shell were found and we ignore the rest. If there is a black dot, you know that only dead or relict shell were found. A black "X" means only relict shell were present.

Mussel shell have also been collected from archeological digs. These are shell that were collected by the native peoples, were cooked and eaten and the shells discarded or reused as ornaments or tools. These sites could be only a few hundred years old to a couple thousand years. These collections indicate what species of freshwater mussel were living in waterbodies in that area and suggest, what may have been the historic range of a species. Very often, these shell are decent condition so are not too hard to identify. These collections are shown by an open circle.

The Mapping Process

I attempted to use all available data to create the maps. The data used comes from three main sources; my own collections, published literature and museum records. These were entered into a spreadsheet which, at this time, has 2,433 records. A "record" is a collection of mussels from a single site on a single day. This collection may have been of a single valve or dozens of shell of multiple species. All represent a single record.

This table summarizes the sources of the data in the database. "Ellet Hoke" has surveyed and published reports on the mussels in 12 of Nebraska's 13 river basins. "Published reports" are additional publications that provide data on the collections of mussels from Nebraska waters. You can find the citations for both the "Ellet Hoke" and "Published reports" in the Literature section at the end of this guide. "Universities" are collections that have not been published as yet. "NGPC staff" are miscellaneous collections by employees of the Nebraska Game and Parks Commission. "Museum records" are records that were found in the collections databases of three museums: The University of Michigan Museum of Zoology, the United States National Museum and The Ohio State Museum of Biological Diversity. "Citizens" are shells that were collected by citizens for which I provided ID assistance.

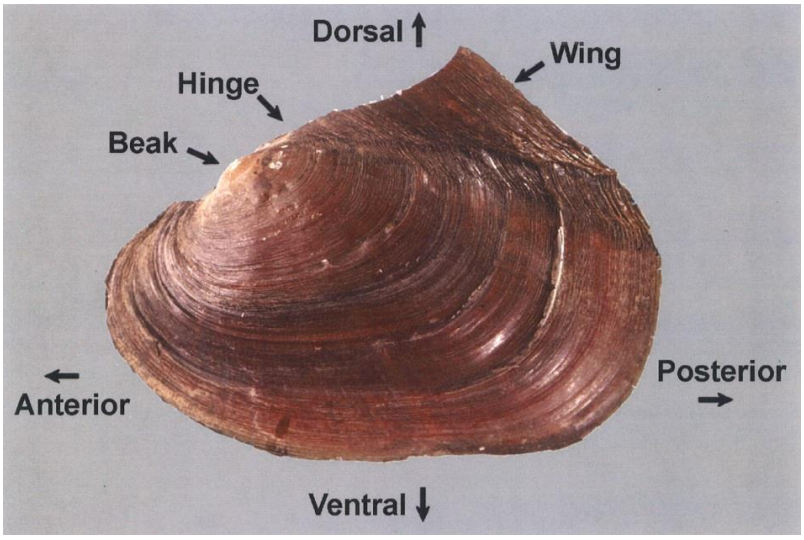
Schainost	1159
Ellet Hoke	564
Published reports	450
Universities	95
NGPC staff	79
Museum records	70
Citizens	23

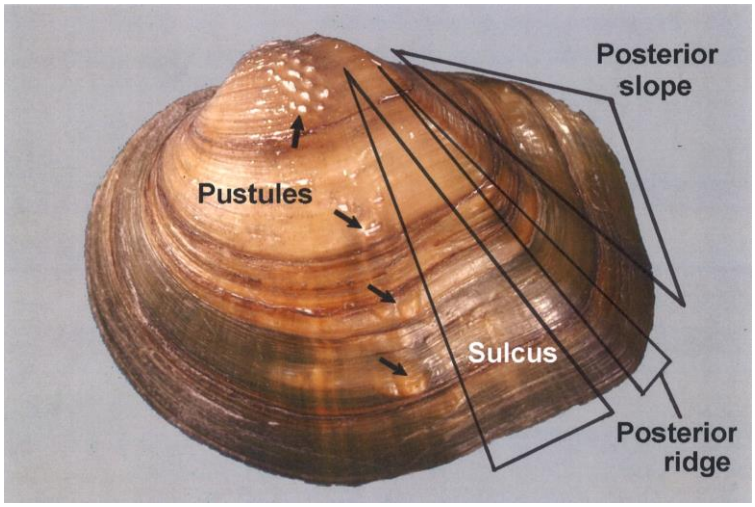
In order to produce a map, we need the latitude and longitude for the collection locations. Many of the data sources required some work to generate these. In the case of my own collections and those of the Universities, the location of collection was often recorded directly with a handheld GPS unit. For the NGPC staff and Citizens, the location could be found on Google Earth and the latitude/longitude could be noted. A number of Museum collections were older records, some of which had meager locational information. If there was enough information to figure out the sample location, then a latitude/longitude pair was calculated. Some of these did not have adequate information so could not be used. The information available in the "Published reports" varied. Two publications did provide latitudes and longitudes for their collection locations.[5, 10] One publication provided detailed descriptions of the collection sites which were sufficient to determine their latitudes and longitudes.[9] Three publications provided maps that were used to determine collection locations.[4, 39, 41] The several reports by Ellet Hoke included both dot maps and tables listing waterbodies sampled as well as species sampled at each location.[18, 19, 20, 21, 22, 24, 25] The dots on the map were numbered and these corresponded with numbered sites in the tables. These maps and tables were used in conjunction with a computer mapping software package (DeLorme 3-D Topoquads, 1999) and 1:24,000 USGS topographic maps to guesstimate his probable collection sites for which latitudes and longitudes were determined. [I should note that while Mr. Hoke has deposited many mussel shells in the Ohio University museum, these were ignored because of the possibility of double counting them.]

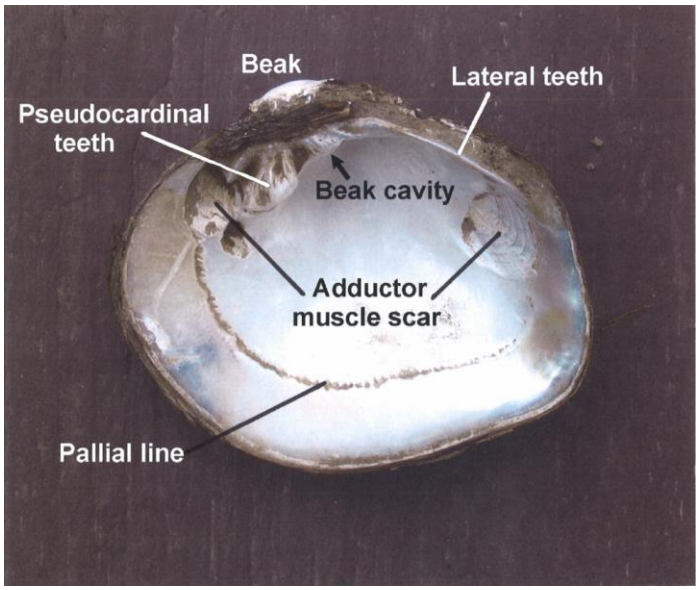
In the field and, subsequently, in the database, shell collections were recorded as "Live", "Fresh dead", "Dead", "Weathered dead" and "Chalky". These data were sorted by species and condition. Then the first two and last two categories were combined into just three categories (Live, Dead, Relict) for mapping. The latitude and longitude data for each species and category were used to create text files. The open-source GIS software QGIS (Version 2.6.1) then used these text files to generate the maps presented here.

Species Accounts

ANATOMY OF THE SHELL







Black Sandshell, *Ligumia recta*

Description: The Black Sandshell is an elongated shell that is fairly heavy and over twice as long as it is high. They can grow to 180mm long. The anterior end is rounded while the posterior is bluntly pointed. The shell is smooth with no pustules, ribs, grooves or other similar structures. There is a broad posterior ridge though this in not really noticeable. The nacre is white. The exterior is a very dark brown or black, hence the name. There are lateral and pseudocardinal teeth. The beak is raised slightly above the dorsal edge. The beak sculpture is composed of some fine ridges

Similar species: This is a pretty distinctive species in Nebraska with no other species being quite a long and narrow as this one. The shape is somewhat similar to that of the Yellow Sandshell though this one has a yellow exterior. It is similar to the Spike (*Elliptio dilatata*) which is found east of Nebraska but the Spike has a pink nacre.

Conservation status: G5, N4, SH. The best specimens have been collected from the Big Blue River. If it is not already extirpated, it is close to being so.

Hosts: Black crappie, bluegill, central stoneroller, common carp, green sunfish, largemouth bass, orangespotted sunfish, pumpkinseed, rock bass, sauger, walleye, white crappie, white perch, yellow perch.

Habitats used: Medium to large rivers in riffles or raceways in gravel or firm sand (Cummings and Mayer 1992). Medium to large rivers in soft or coarse substrate and flowing water (Seitman 2003). Small to large-sized gravel in water with good current (Oesch 1995). Medium to large rivers in areas with strong current and substrates of coarse sand and gravel with cobbles (Parmalee and Bogan 1998). Widespread but sporadic in rivers and lakes, less commonly in streams. May use soft or hard substrates (Watters et.al. 2009).

Distribution: The Mississippi River basin from New York to North Dakota down Texas to Alabama. Also Alabama River basin, Red River of the North, and St. Lawrence basin.

Collection notes: Shell of this species has most commonly been found in the Big Blue River. They have also been found in the Big Nemaha and South Fork Big Nemaha Rivers and Logan Creek. Most collections have been of relict shell. Only one collection of a dead shell from the upper Big Blue River. Archeologically, this was fairly common in southeastern Nebraska.

Comments: This is another species which, looking at the long list of host fishes and the suitable habitats, is a puzzle. Why have they almost totally disappeared? They should be doing fine.

Black sandshell, *Ligumia recta*

Cross section of Black sandshell, 138mm, anterior end is to the left

Big Blue River, Seward County, 130mm

Big Blue River, Seward County, 130mm

Big Blue River, Seward County, 130mm

Big Blue River, Seward County, 113mm

Big Blue River, Seward County, 130mm

Bleufer, *Potamilus purpuratus*

Description: The Bleufer has a large oval-shaped shell that can get as large as 170mm in length. The shell is greatly inflated and has a small wing on the posterior dorsal edge of the shell. The nacre varies from pink to deep purple. The exterior is smooth and very dark brown to black. The anterior end is rounded and narrower than the posterior end which is squarish. The beaks are raised above the hinge line. There really isn't any beak sculpture that I can see.

Similar species: It is quite similar to the Pink Heelsplitter. The Pink Heelsplitter tends to have a large wing that the Bleufer lacks. The Bleufer is more inflated than the Pink Heelsplitter.

Distribution: The Mississippi River basin and Gulf Coast drainages from Texas to Florida and Alabama then up to Illinois.

Conservation status: G5, N5, SX. This one is extirpated from the state.

Hosts: Freshwater drum, golden shiner.

Habitats used: Large rivers in mud or mixed mud and gravel (Cummings and Mayer 1992). Large rivers in small to medium gravel, sometimes with mud (Oesch 1995). Quiet or slow-moving water in mud or gravel bottom (Parmalee and Bogan 1998). Large or smaller reservoirs, streams or rivers with slow to moderate currents, slow-moving sloughs on mud or gravel (Howells et.al. 1996).

Collection notes: This species has only been found as relict shell in three locations, the Big Blue River, South Fork Big Nemaha River, and Logan Creek.

Comments: Nebraska is quite a way outside the known range of this species so finding any here is something of a surprise. This one of those species that, apparently, has always been incredibly rare.

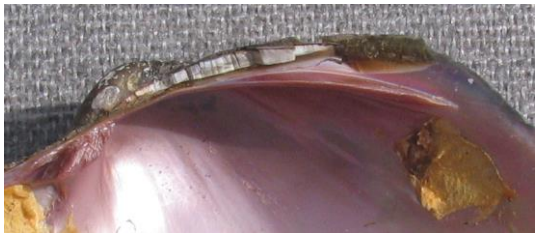
Bleufer, *Potamilus purpuratus*

Loan from Arkansas, 96mm

Loan from Arkansas, 96mm, dorsal

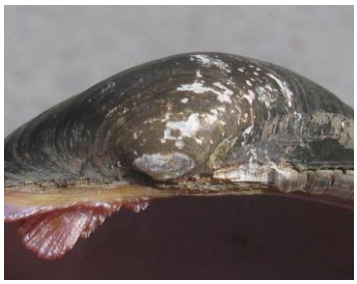
Loan from Arkansas, 96mm, anterior view

Loan from Arkansas, 128mm



Loan from Arkansas, 96mm, view of teeth

Archeology site 25WN1: 185/22, 115mm



Loan from Arkansas, 96mm, beak sculpture

Creek Heelsplitter, *Lasmigona compressa*

Description: The Creek Heelsplitter is a smaller shell which gets up to 100-110mm. It is somewhat compressed and comparatively thin shelled. The anterior end is rounded and the posterior tip is squared like that of the White Heelsplitter. The nacre is white. The exterior is light brown, tan or greenish and may have numerous green rays on the posterior end. The beaks are low and the sculpture consists of several double-looped ridges.

Similar species: It looks like a smaller White Heelsplitter but the difference is that the lateral teeth do not have the wavy texture of the White Heelsplitter but look like regular lateral teeth.

Conservation status: G5, N5, SH. The Creek Heelsplitter is probably extirpated from Nebraska.

Hosts: Black bullhead, black crappie, bluegill, brassy minnow, brook stickleback, creek chub, emerald shiner, flathead catfish, gizzard shad, green sunfish, longnose dace, orangespotted sunfish, shortnose gar, smallmouth bass, spotfin shiner, yellow bullhead, yellow perch

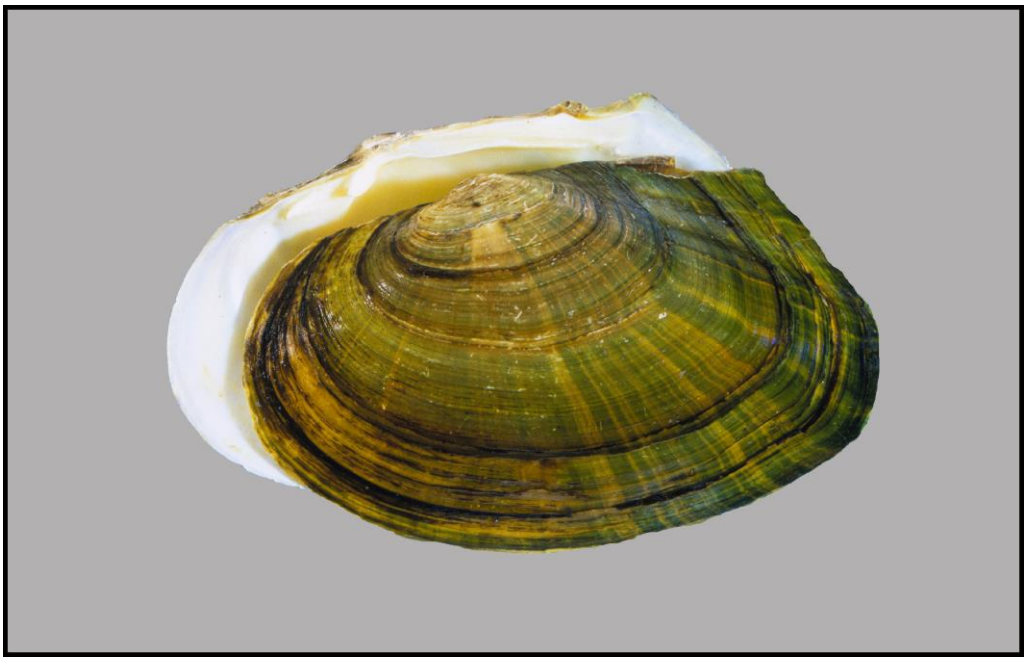
Habitats used: Creeks and headwaters of small to medium rivers in fine gravel or mud (Cummings and Mayer 1992). Creeks to medium rivers in soft or coarse substrate (Seitman 2003). Clean creeks in sand or cobble, in main current or slackwater (Watters et.al. 2009).

Distribution: The upper Mississippi River system, Ohio River drainage except for Tennessee and Cumberland Rivers. Great Lakes tributaries. Hudson River and some tributaries to the St. Lawrence River.

Collection notes: This species is rare being found only once in Logan Creek and once in Omaha Creek.

Comments: This species looks a lot like a small White Heelsplitter. It appears to have been extremely rare and on the edge of its range in Nebraska.

Creek heelsplitter, *Lasmigona compressa*



Courtesy of Dr. Kevin Cummings, Illinois Natural History Survey

Creeper, *Strophitus undulatus*

Description: A small, short-lived species, rarely getting over 100mm. Somewhat oval shaped with a shell height being a bit more than half the shell length. The shell is thin, especially in juveniles, with no lateral or pseudocardinal teeth. The beak sculpture is composed of 3 or 4 coarse ridges which (rarely) may appear to be double looped. The nacre is white. Juveniles are a light tan which darkens to dark brown as they age. Juveniles and sometimes, adults, have faint green rays radiating from the beak to the edges of the shell.

Similar species: Juvenile Giant floaters can be very similar but their double looped beak sculpture is usually quite distinctive. Also, juvenile Creepers have faint green rays the Giant floater does not have. The Paper pondshell has a thinner shell and the beaks are almost flat with no sculpturing. Cylindrical papershell is so similar, including their beak sculpture, that it can be very frustrating to decide which species you have in hand. As a general rule, the Cylindrical papershell is more inflated and not a broad in the dorsal/ventral direction.

Conservation status: G5, N5, S3

Hosts: Black bullhead, black crappie, blacknose dace, blackside darter, bluegill, bluntnose minnow, brook stickleback, burbot, central stoneroller, channel catfish, common shiner, creek chub, fathead minnow, green sunfish, Iowa darter, johnny darter, largemouth bass, longnose dace, northern redbelly dace, plains killifish, pumpkinseed, rock bass, sand shiner, smallmouth bass, spotfin shiner, walleye, white crappie, yellow bullhead, yellow perch.

Habitats used: Small to medium streams and, occasionally, large rivers in mud, sand or gravel (Cummings and Mayer 1992). Small to large streams in gravel or mud-gravel substrate (Oesch 1995). Adaptable to a variety of habitats from high-gradient streams to meandering or channelized streams (Parmalee and Bogan 1998). Intermittent creeks to large rivers (Watters et.al. 2009).

Distribution: Widespread in North America. From 100th Meridian to east coast from Mexico to Manitoba to Ontario/Maine down to central North Carolina. Not found in southeastern U.S. (Alabama to North Carolina and south).

Collection notes: The bulk of collections have been of relict and dead shell, particularly in the eastern portion of the state. Lives have been only been found in the Middle Platte River, Middle Loup River and in the Taylor-Ord Canal off the North Loup River.

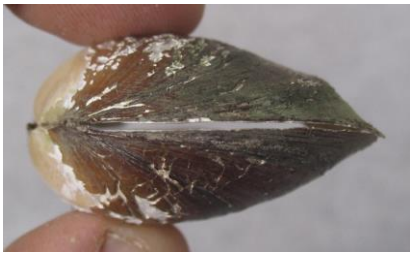
Comments: Given its habitat generalization and numerous host fishes, this species should be doing much better.

Creeper, *Strophitus undulatus*

Cross section of Creeper, 65mm, anterior end is to the right

Taylor-Ord Canal, Loup County, 78mm

Taylor-Ord Canal, Loup County, 78mm, dorsal view



Taylor-Ord Canal, Loup County, 78mm, anterior view

Taylor-Ord Canal, Loup County, 35mm juvenile

Middle Loup River, Valley County (Upper = Giant floater), (Lower = Creeper), both 60mm

Taylor-Ord Canal, Valley County, 40mm, beak sculpture

Cylindrical papershell, *Anodontoides ferussacianus*

Description: A small, short-lived species, rarely getting over 100mm. An elongated oval shape with a shell height being about half the shell length. The anterior end is a rounded and the posterior is wide, blunt point. The shell is thin, especially in juveniles, with no lateral or pseudocardinal teeth. The beak sculpture is composed of 3 or 4 fine v-shaped ridges. The nacre is white. Juveniles are a light tan which darkens to dark brown as they age. .

Similar species: They are quite similar to the Paper pondshell in general shape though these have a much thinner shell and the beaks are almost flat with no sculpturing. Juvenile Giant floaters can appear similar but their more oval shape and their double looped beak sculpture is distinctive. The Creeper is so similar, including their beak sculpture, that it can be very frustrating to decide which species you have in hand. As a general rule, the Cylindrical papershell is more inflated and appears more elongated than the Creeper.

Conservation status: G5, N5, S4

Hosts: Black crappie, blacknose shiner, bluegill, bluntnose minnow, brook stickleback, common shiner, fathead minnow, Iowa darter, largemouth bass, spotfin shiner, white sucker.

Habitats used: Small creeks and the headwaters of larger streams in mud and sand (Cummings and Mayer 1992). Small to medium-sized streams in soft or coarse substrate (Seitman 2003). Small streams (Oesch 1995). Small, quiet streams in sand or fine gravel (Parmalee and Bogan 1998). Headwater streams on packed cobble to silty mud and clay (Watters et.al. 2009).

Native range: The Mississippi River basin from Oklahoma to Colorado to Minnesota to New York. St. Lawrence River and Great Lakes. Ontario to Saskatchewan in Canada.

Nebraska collection notes: This species has been found quite widely throughout Nebraska although, when found, they are found in small numbers.

Comments: This species seems to be doing ok in Nebraska. If you look at the list of fish hosts, you will note that they are predominately small stream fishes.

Cylindrical papershell, *Anodontoides ferrussacianus*

Cross section of Cylindrical papershell, 80mm, anterior end is to the left

South Channel Platte River, Lincoln County, 77mm

South Channel Platte River, Lincoln County, 77mm

South Channel Platte River, Lincoln County, 77mm

Niobrara River, Dawes County, 60mm

South Channel Platte River, Lincoln County, 77mm

Deertoe, *Truncilla truncata*

Description: This is a smaller mussel, seldom getting much over 80-90mm. The shell is thick and has a somewhat triangular outline. The anterior end is rounded while the posterior end is pointed with a prominent posterior ridge. When you put both valves together, the posterior slopes form a flattened area. The beaks of the two valves curl around until they meet each other. The beak sculpture, such as it is, is some barely visible double-looped ridges. The nacre is white. The exterior can vary from greens, browns, tans or yellowish with numerous green rays. The rays may have darker zig-zag markings within them. Older individuals often darken to the point that the rays are hard to see.

Similar species: Juvenile Deertoe are similar to the Fawnsfoot though adults get much larger. The Fawnsfoot tends to be more elongate and its posterior ridge isn't as sharp. The Fawnsfoot may have visible beak sculpture consisting of several fine looped ridges.

Hosts: Freshwater drum, sauger

Conservation status: G5, N5, S3. Live or fresh dead specimens have only been found in only two areas (Missouri River and Weeping Water Creek) which means the species could be vulnerable to catastrophic events.

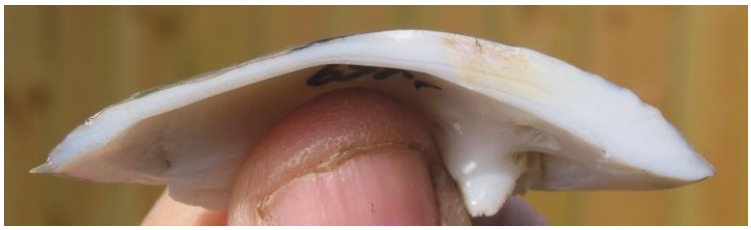
Habitats used: Medium to large rivers in mud, sand, or gravel (Cummings and Mayer 1992). Found in a variety of substrates ranging from mud-gravel to large rocks in moderately swift water. (Oesch 1995). Generalized in substrates used, often a composite of fine gravel with sand and mud in medium and large rivers. Can adapt to lakes (Parmalee and Bogan 1998). Rivers and lakes in packed sand and gravel. Rarely found in smaller streams (Watters et.al. 2009).

Distribution: Widespread in Mississippi River basin. From Texas north into Minnesota, through the Great Lakes states into Pennsylvania then following the Appalachians through Mississippi to the Gulf.

Collection notes: Live or fresh dead Deertoe have been found in the Missouri River downstream of Gavins Point Dam and in Weeping Water Creek in Cass County. There is an archeological record from Sarpy County.

Comments: This is a small mussel that prefers large rivers so records may be scant for that reason. Archeological data suggests it has always been uncommon in this state. That it is seldom found in smaller streams may indicate that it's host fish is a big river fish.

Deertoe, *Truncilla truncata*



Cross section of Deertoe, 59mm, anterior end is to the right

Missouri River, Cedar County, 71mm

Missouri River, Cedar County, 56mm, dorsal view

Missouri River, Cedar County, 56mm, anterior view

Missouri River, Cedar County, 30mm

Missouri River, Cedar County, 56mm, beak sculpture

Fatmucket, *Lampsilis siliquoidea*

Description: The Fatmucket is a medium sized shell up to 120-130mm. The shell is fairly thick and heavy. The anterior end in both sexes is rounded. In males, the posterior end is slightly broader than the anterior end and bluntly pointed. The posterior of the shell of mature females is broader than the anterior end, very inflated and squared. The exterior is tan or brown and smooth. Younger individuals may have radiating green rays on the posterior end. The beaks are raised slightly above the dorsal edge and the sculpture consists of several fine V-shaped wavy ridges.

Similar species: The Fatmucket is similar to the Yellow Sandshell in overall shape and shell thickness. The Yellow Sandshell is more elongated and their adults are yellow where the Fatmucket is brown.

Conservation status: G5, N5, S1/SH. A live specimen and several dead shell in good condition have been collected from the Big Blue River. The current status is not known but they may be extirpated or nearly so.

Hosts: Bluegill, bluntnose minnow, green sunfish, largemouth bass, pumpkinseed, rock bass, sand shiner, smallmouth bass, white sucker.

Habitats used: Lakes and small to medium-sized streams in mud, sand, or gravel (Cummings and Mayer 1992). Large rivers and lakes in river flowages in soft or coarse substrate (Seitman 2003). Almost any substrate in moderate to slowly moving water. May be found in mud substrates of lakes (Oesch 1995). Quiet to slowly moving water with a mud bottom, avoiding riffles (Parmalee and Bogan 1998). Nearly all substrates and flow regimes from extreme headwaters to ponds, lakes, and rivers. Rare in largest rivers (Watters et.al. 2009).

Distribution: The Mississippi River basin except for Tennessee and Cumberland River drainages. New York to Minnesota south to Arkansas. Great Lakes tributaries and south-central Canada.

Collection notes: This species is mostly found as relict shell in the Nemaha and Big Blue River basins. Also has been found as relicts in lower Elkhorn and Logan Creek. One collection of dead shell below Gavins Point Dam. A single live was found in lower Big Blue River. The archeological records show that they were once widely distributed.

Comments: This was once a common species that has severely declined for unknown reasons. Note that the Big Blue was heavily fragmented by power dams in the late 1800's and the Nemaha (and Logan Creek) were channelized in the early 1900's.

Fatmucket, *Lampsilis siliquoidea*

Cross section of Plain pocketbook, 101mm, anterior end is on the right

Silver Creek, Otoe County, 93mm female

Silver Creek, Otoe County, 93mm, dorsal view

Silver Creek, Otoe County, 93mm, anterior view

Big Blue River, Gage County, 104mm, male

Archeological site 25SY3, Sarpy County, 80mm, beak sculpture

Fawnsfoot, *Truncilla donaciformis*

Description: This is a small mussel, seldom getting much over 50mm. The shell is thick and has a somewhat triangular outline. The anterior end is rounded while the posterior end is pointed. The posterior ridge is rounded. When you put both valves together, the posterior slopes form a flattened area. The beaks of the two valves curl around until they meet each other. The beak sculpture is a series of fine looped ridges. The nacre is white. The exterior can vary from greens, browns, tans or yellowish with numerous green rays. The rays may have darker zig-zag markings within them.

Similar species: Juvenile Deertoe are similar to the Fawnsfoot though adults get much larger. The Fawnsfoot tends to be more elongate and its posterior ridge isn't as sharp. The Fawnsfoot may have visible beak sculpture consisting of several fine looped ridges that the Deertoe does not have.

Hosts: Freshwater drum, sauger Conservation status: G5, N5, S3. Its status in Nebraska is indeterminate. They may be present in the Missouri River.

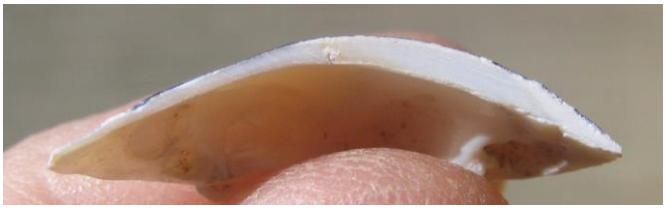
Habitats used: Large rivers or the lower reaches of medium-sized streams in sand or gravel (Cummings and Mayer 1992). Small and large rivers (Oesch 1995). Large and medium- sized rivers in sand or mud. Can adapt to lake or embayment environment. (Parmalee and Bogan 1998). Rivers and lakes in packed sand and gravel. Rarely found in smaller streams (Watters et.al. 2009).

Distribution: Widespread in Mississippi River basin. From Texas north into Minnesota, through the Great Lakes states into Pennsylvania then following the Appalachians through Mississippi to the Gulf.

Collection notes: The Fawnsfoot has only been found in the Missouri. There is an archeological record from Sarpy County.

Comments: This is a very small mussel that prefers large rivers so records may be scant for that reason. Archeological data suggests it has always been rare in this state. That it is seldom found in smaller streams may indicate that its host fish is a big river fish.

Fawnsfoot, *Truncilla donaciformis*



Cross section of Fawnsfoot, 30mm, anterior end is to the right

Archeology site 25SY3: 42/96, Sarpy County, 25mm

Mississippi River, Milan, IL, 24mm, dorsal view

Mississippi River, Milan, IL, 24mm, anterior view

Archeology site 25SY3: 42/96, Sarpy County, 25mm

Mississippi River, Milan, IL, 29mm

Archeology site 25SY3: 42/96, Sarpy County. 25mm, beak sculpture

Flat floater, *Utterbackia suborbiculata*

Description: The Flat Floater has a distinctive shell that is almost as high as it is long. The shell is really thin and compressed. The shell has no pseudocardinal or lateral teeth. The nacre is white or pale pink. The epidermis is tan with dark growth rings. The beak area is flat and even with the dorsal edge while the beak sculpture consists of a several small bumps or pustules.

Similar species: The Flat Floater would be hard to confuse with any other Nebraska species. The Giant Floater is most similar but their beaks with the double-looped sculpture and their inflated shell easily distinguishes them.

Conservation status: G5, N5, S1. Prior to the 2010-11, this species was rarely found in the Missouri River. Construction of backwater habitat at mitigation sites as well as the construction of marinas coupled with the disturbance of the 2011 floods have greatly expanded the range and numbers of Flat Floaters in the Missouri River. If their populations hold up now that the river has returned to normal operations, their status could be upgraded.

Hosts: Channel catfish, golden shiner, green sunfish, largemouth bass, white crappie.

Habitats used: Ponds, lakes, sluggish mud-bottom pools of creeks and rivers (Cummings and Mayer 1992). Large rivers, backwaters, or sloughs in soft substrate (Seitman 2003). Lakes, sloughs, quiet segments of rivers with mud bottoms (Oesch 1995). Lakes, sloughs, shallow backwaters of larger rivers on mud (Parmalee and Bogan 1998). Soft stable sediment in pools, backwaters, and low flow reaches of large rivers (Watters et.al. 2009).

Native range: The Mississippi River basin from Nebraska to Wisconsin and Ohio then down to Louisiana and Alabama

Nebraska collection notes: In recent years, abundant numbers of Flat floaters have been collected from the Missouri River from off-channel quiet water areas between the Platte River and Gavins Point Dam.

Comments: It has been noted in the literature that this species may be extending its range due to impoundment of large rivers. Its expanded presence in the Missouri river may be due to the construction of off-channel backwater habitats such as marinas and mitigation sites. The 2011 Missouri River flood was a two-edged sword. The flood may have helped them, via their fish hosts, to enter many new areas but huge numbers were stranded and died when the flood waters went down.

Flat Floater, *Utterbackia suborbiculata*

Cross section of Flat floater shell, 147mm, anterior end on left

Missouri River, Dixon County, 147mm

Missouri River, Dixon County, 147mm, dorsal view

Missouri River, Dixon County, 147mm, anterior view

Missouri River, Dixon County, 42mm juvenile

Missouri River, Dixon County, 147mm

Fragile Papershell, *Leptodea fragilis*

Description: The Fragile Papershell has an oval-shaped, thin and compressed shell that can get up to 140-150mm. The shell has a smooth, waxy exterior that is a yellow-tan color. Juveniles will have light green stripes on the posterior of the shell. The anterior is rounded and may have a tiny wing. The posterior is also rounded may small wing. The wings are most noticeable in juveniles. The nacre is white, occasionally with pink tones. The teeth are small and thin. The beaks are low and smooth with almost no visible beak sculpture.

Similar species: The Fragile Papershell is often found along with the Pink Papershell which it resembles. The Fragile Papershell is always a yellow-tan color with white nacre while the Pink Papershell is a dark brown with dark pink or purple nacre.

Conservation status: G5, N4, S4. The species is doing quite well in the Missouri River. It is also present in several other drainages but not doing as well there.

Hosts: Freshwater drum.

Habitats used: Streams of all sizes in mud, sand, or gravel (Cummings and Mayer 1992). Medium to large rivers in soft or coarse substrate (Seitman 2003). Small streams to large rivers with clear to murky water and mud, mud-gravel, or gravel substrates (Oesch 1995). Small streams with strong current in coarse gravel and sand substrate. Rivers or river-lakes with slow current and firm sand/mud substrate (Parmalee and Bogan 1998). Large streams, rivers and lakes on substrates varying from sandy mud to packed cobble (Watters et.al. 2009).

Distribution: The Mississippi River basin, Gulf Coast from Texas to Alabama, Great Lakes and St. Lawrence.

Collection notes: This species has been found as relict, dead and live in many areas in the eastern quarter of Nebraska. It is particularly common in Missouri River.

Comments: The Fragile Papershell is doing ok though not as well as some other species. The habitat needs are pretty general though only one known host and barriers to the movement of host fish may be a limiting factor in some streams. Live Fragile Papershells have been found in the Little Blue below the Fairbury Dam but not above. In the Big Blue River they were found below the Blue Springs Dam but not above. Mother Nature removed the Blue Springs dam several years ago so maybe the species will be found upstream.

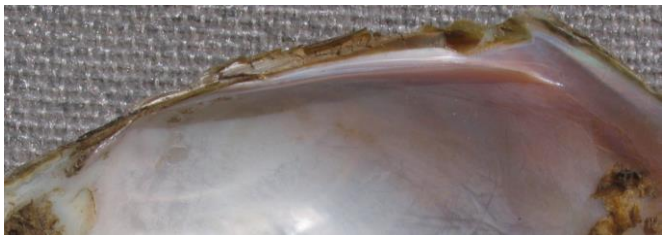
Fragile Papershell, *Leptodea fragilis*

Cross section of Fragile papershell, 145mm, anterior end is on the right

Missouri River, Cedar County. 145mm

Missouri River, Dixon County, 105mm, dorsal view

Missouri River, Dixon County, 105mm, anterior view



Missouri River, Dixon County, 105mm, closeup of tooth structure

Big Blue River, Gage County, 35mm juvenile

Missouri River, Dixon County, 105mm, beak sculpture

Giant floater, *Pyganodon grandis*

Description: The Giant Floater is a thin-shelled, inflated species than can get over 200mm. The shell is a long oval that is glossy and smooth with some exceptions. Their color can vary from light tan to green/brown to almost black. The nacre is white, sometimes with a light pinkish cast. The beaks are low and their sculpture consists of a series of double-looped ridges.

Similar species: Adult Giant Floaters are so large and fat that they are hard to confuse with other mussels. Juveniles, on the other hand, can be similar to the Cylindrical Papershell and, especially, the Creeper. All three lack hinge teeth and have thin, smooth shells. Only the Giant Floater has the double-looped beak sculpture where the other two have single loops.

Conservation status: G5, N5, S5. They are widespread and abundant over the whole state.

Hosts: Black crappie, blacknose dace, blacknose shiner, bluegill, bluntnose minnow, brook silverside, brook stickleback, central stoneroller, common carp, common shiner, creek chub, freshwater drum, gizzard shad, golden shiner, goldfish, green sunfish, Iowa darter, johnny darter, lake sturgeon, largemouth bass, longnose gar, orangespotted sunfish, pearl dace, pumpkinseed, river carpsucker, rock bass, skipjack herring, white bass, white crappie, white sucker, yellow bullhead, yellow perch.

Habitats used: Ponds, lakes, and sluggish mud-bottomed pools of creeks and rivers. Can be found in a variety of other habitats as well (Cummings and Mayer 1992). Quiet water with mud or mud-gravel bottoms but may adapt to lake environments (Oesch 1995). Found in rivers with sand and gravel beds but most common in reservoirs, lakes, and ponds with mud bottoms (Parmalee and Bogan 1998). Widespread and common species found in nearly every type of substrate and water flow (Watters et.al. 2009).

Distribution: Wide distribution from Mexico through the central Great Plains up into Canada on the west and Alabama to Ontario on the east. Basically from the Appalachian Mountains to the 100th Meridian.

Collection notes: This species is widespread over all of Nebraska. Archeologically, the Giant Floater was fairly uncommon

Comments: Our most common species, it is found throughout the state, probably due to the construction of numerous impoundments where it is able to do well. Its broad range of host fishes may also lead to its introduction into new waterbodies via the stocking of glochidia-infested fish. For instance, in the White River basin, they are only found in reservoirs, Carter P. Johnson Lake, Whitney Reservoir, the Chadron State Park pond and the Chadron City Reservoir.

Giant Floater, *Pyganodon grandis*

Cross section of Giant floater, 130mm, anterior end is to the left

Lake Minatare, Scottsbluff County, 119mm

Yankee Hill Reservoir, Lancaster County, 130mm,

Yankee Hill Reservoir, Lancaster County, 130mm, anterior view

West Fork Big Blue River, Adams County, 95mm

Missouri River, Dixon County, 35mm juvenile

West Fork Big Blue River, York County, 168mm

Chadron City Reservoir, Dawes County, 75mm, beak sculpture

Hickorynut, *Obovaria olivaria*

Description: The Hickorynut is a medium-sized mussel (up to 100-110mm) that has a really thick, heavy shell. It has a rounded shell that looks lopsided as the posterior end is much longer than the anterior end. The shell is smooth and a yellowish brown color. The nacre is white. The beaks are prominent and curl around to meet each other to the point that they rub. The beak sculpture is not very evident but is supposed to be fine double-looped ridges.

Similar species: There really aren't any other species in Nebraska that look like this except for the Higgins Eye. The Higgins Eye is supposed to have green rays that the Hickorynut lacks. The female Higgins Eye has a greatly inflated shell. Since the Higgins Eye is endangered, finding any shell that looks like this is cause for notifying someone of the find. Please note that there are many other species of mussel, not found in Nebraska, that look like this.

Conservation status: G4, N4, SX. This species was always rare and is extirpated from the state.

Hosts: Lake sturgeon, shovelnose sturgeon.

Habitats used: Large rivers in sand or mixed sand and gravel (Cummings and Mayer 1992). Medium to large rivers in soft or coarse substrate and flowing water (Seitman 2003). Small to large gravel or mud-gravel in rivers (Oesch 1995). Found on sand or gravel substrates in deep water with good current (Parmalee and Bogan 1998). Muddy sand or gravel in rivers and lakes (Watters et.al. 2009).

Distribution: The Mississippi River basin from western Pennsylvania and New York to Kansas, north to Minnesota, and south to Louisiana. St. Lawrence from Lake Ontario to Quebec.

Collection notes: This species has been found twice as relict shell, once in the Big Blue River and once in Logan Creek. It was identified from one archeological site in Sarpy County.

Comments: This really could hardly be claimed to be a Nebraska species as it was always very rare.

Hickorynut, *Obovaria olivaria*

Mississippi River, Rock Island County, 60mm, anterior end is to the left

Mississippi River, Rock Island County, 60mm

Mississippi River, Rock Island County, 60mm, dorsal view

Mississippi River, Rock Island County, 60mm, anterior view

Big Blue River, Gage County

Archeological site 25SY1: 26/3, 56mm

Higgins eye, *Lampsilis higginsii*

Description: The Higgins eye is a smaller mussel, growing up to 100mm. The shell is rounded, thick and heavy. In the male, both ends are rounded. In the female, the posterior end is inflated and squared off. The shell is smooth and yellowish brown, often with green rays on the posterior end. The nacre is white. The beaks are elevated above the dorsal margin and turn toward each other. The beak sculpture is supposed to be some double-looped ridges though I could see none on this specimen.

Similar species: The Higgins eye is similar to the Plain Pocketbook and the Hickorynut. The Hickorynut does not have green rays and is longer on the posterior end. The Plain Pocketbook gets larger, is generally a light tan color and has a beak sculpture of several heavy ridges. The collection of any shell suspected to be a Higgins eye should be reported.

Hosts: Bluegill, freshwater drum, green sunfish, largemouth bass, northern pike, sauger, smallmouth bass, walleye, yellow perch.

Conservation status: G1, N1, S1. A single valve is the total justification for this designation. Directed searches have not found any more to date.

Habitats used: Mississippi River and larger tributaries in gravel or mud (Cummings and Mayer 1992). Large rivers in soft or coarse substrate (Seitman 2003). Large rivers on stable substrates from sand to boulders but not firmly packed clay, flocculent silt, organic material, bedrock or shifting sand (U.S. Fish and Wildlife Service 2003).

Native range: The Mississippi River from Missouri to Minnesota.

Nebraska collection notes: This species was collected before 1900 in the middle Elkhorn River. A single valve in good condition was collected in the Missouri River at RM 809.8 in September 2004.

Comments: The photographs are of a specimen collected from the upper Mississippi River. The Missouri River of Nebraska is outside the range of this species which is normally the upper Mississippi River. It is not outside the realm of possibility that a glochidea-carrying fish swam all the way from the Mississippi, up the Missouri to Gavins Point Dam where the juvenile dropped off. Far-fetched, perhaps, but not impossible. This also holds for the Elkhorn River collection. This last one is indicated as a "live" collection on the map but please note that this collection was made in the 1880's.

Higgins eye, *Lampsilis higginsii*

Mississippi River, Prairie du Chien, 95mm

Mississippi River, Prairie du Chien, 95mm, dorsal view

Mississippi River, Prairie du Chien, 95mm, posterior view

Mississippi River, Prairie du Chien, 95mm

Mississippi River, Prairie du Chien, 95mm, beak sculpture

Lilliput, *Toxolasma parvum*

Description: The Lilliput is a small mussel, rarely getting as large as 50mm though most are smaller. Its shape is a long oval that looks somewhat rectangular and is really inflated for its size. The shell is thin and has a coarse exterior, often described as "cloth-like" which is accurate. It is usually a dark brown color. The nacre is white. The anterior end is rounded and the posterior end is somewhat truncated and squarish. They have lateral and pseudocardinal teeth. The beaks are low and have a sculpturing of several coarse concentric ridges.

Similar species: There are no other species of mussel in Nebraska that look quite like a Lilliput.

Conservation status: G5, N5, S4. This species may be doing ok in southeastern Nebraska. It is a very small mussel so could be easily overlooked so records may be incomplete.

Hosts: Bluegill, green sunfish, johnny darter, orangespotted sunfish, white crappie.
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Habitats used: Ponds, lakes and creeks to large rivers in mud, sand and gravel (Cummings and Mayer 1992). Quiet water areas on mud or mud and sand (Oesch 1995). Shallows of lakes, ponds, and reservoirs as well as small to large rivers on mud, sand or fine gravel (Parmalee and Bogan 1998). Most common in muddy sand or clay in creeks and impoundments (Watters et.al. 2009).

Distribution: Widespread in North America. From the bottom tip of Texas through the Great Plains states to Canada, east to New York then down through Tennessee to Louisiana.

Collection notes: Most records for the Lilliput are from the Big Blue River basin but they have also been found in the Nemaha, the Lower Platte, the Missouri Tributaries, the Elkhorn and Loup basins. I have also found them in the Missouri River below Gavins Point Dam. Lives have been found in the Salt Creek watershed, Indian Creek (Big Blue basin), and Summit Reservoir (Missouri Tributaries basin). There are archeological records from the Republican basin.

Comments: I would like to know more about this cute little mussel. As it rarely exceeds 50mm, it can be easily overlooked so may be more common than the records indicate since it does well in impoundments. I would particularly look at reservoirs in the southeast such as the Salt Valley, Papio and NRD watershed reservoirs.

Lilliput, *Toxolasma parvum*

Cross section of Lilliput, 43mm, anterior end is to the

Yankee Hill Reservoir, Lancaster County, 43mm

Summit Lake, Burt County, 38mm, dorsal view

Summit Lake, Burt County, 38mm, anterior view

Summit Lake, Burt County, 38mm, live

Memphis Lake, Saunders County, 15mm juvenile

Summit Lake, Burt County, 38mm, beak sculpture

Mapleleaf, *Quadrula quadrula*

Description: The Mapleleaf is a smaller mussel, usually less than 125mm long. It is squarish in outline. The anterior end is rounded. The posterior end has a prominent sulcus (groove) ahead of a posterior ridge. Some Mapleleafs have a smooth exterior but most have two rows of large pustules, one on each side of the sulcus. The color is a light tan in young Mapleleafs while older individuals are a medium or dark brown. The nacre is white. The anterior end of the shell is fairly thick while the posterior is much thinner. The pseudocardinal teeth are large and heavy while the lateral teeth are short and moderately heavy. The beaks are raised above the dorsal margin. The beak sculpture consists of an extension of the rows of pustules that wrap right around the beak.

Similar species: The Mapleleaf and Pimpleback are often found together and are quite similar. The Mapleleaf tends to be more squarish, has a deeper sulcus, has rows of pustules on both sides of the sulcus and is a bit more compressed. The Pimpleback is rounder, has a barely visible sulcus, is more inflated and, in Nebraska, seldom has pustules. If pustules are present, they tend to run right down the middle of the sulcus. Young Pimplebacks have a single broad green stripe down the middle of the sulcus which is sometimes still visible in adults.

Conservation status: G5, N5, S5. The Mapleleaf is one of the species that is doing well.

Hosts: Channel catfish, flathead catfish.

Habitats used: Medium to large rivers and reservoirs in mud, sand or gravel (Cummings and Mayer 1992). Rivers on bottoms with small to medium gravel or rocks. May adapt to a lake environment (Oesch 1995). An adaptable species that does well in shallow lakes or deep reservoirs on sand or gravel substrate (Parmalee and Bogan 1998). Moving water in muddy sand and cobble in large creek and rivers, lakes, and large impoundments (Watters et.al. 2009).

Distribution: Pretty much the entire Mississippi River basin as far north as North Dakota and Minnesota. Also the Red River of the North into Canada.

Collection notes: The Mapleleaf is fairly widespread in the southeastern half of the state. While it is common in the Big Blue River where it is found on rock riffles, it can also be found in many impoundments. This is the single most common species retrieved from archeological sites, especially in the Republican basin where it is now almost extinct.

Comments: The Mapleleaf seems to do well both in streams and reservoirs.

Mapleleaf, *Quadrula quadrula*

Cross section of Mapleleaf, 95mm, anterior end is on the right

Big Blue River, Butler County, 85mm

Big Blue River, Butler County, 85mm, dorsal view

Big Blue River, Butler County, 85mm, anterior view

Memphis Lake, Saunders County, 77mm, Mapleleaf lacking pustules

Big Blue River, Gage County, 25mm juvenile

Big Blue River, Butler County, 85mm, beak sculpture

Mucket, *Actinonaias ligamentina*

Description: The Mucket is oblong or oval shaped and can get quite large (up to 175mm). The shell is compressed and moderately thick with the anterior end being thicker than the posterior. The anterior end is rounded while the posterior end is bluntly pointed. The shell is smooth with a broad posterior ridge. The color is yellowish or greenish with green rays though older individuals can get quite dark. The pseudocardinal teeth are large and prominent. The lateral teeth are typical, two in the left valve, one in the right. The beak sticks very slightly above the dorsal margin. The beak sculpture is not very visible.

Similar species: The Mucket most resembles a Fatmucket. The Fatmucket is more elongate (male) or more inflated (female). The beak sculpture of the Fatmucket is a series of V-shaped ridges.

Conservation status: G5, N5, SX. The Mucket is extirpated from Nebraska though the sum total of collections is two relict shell.

Hosts: American eel, black crappie, bluegill, central stoneroller, common carp, green sunfish, largemouth bass, orangespotted sunfish, rock bass, sauger, smallmouth bass, tadpole madtom, white bass, white crappie, yellow perch.

Habitats used: Medium to large rivers in gravel or mixes sand and gravel (Cummings and Mayer 1992). Medium to large rivers in soft or coarse substrate and flowing water (Seitman 2003). Stable gravel bottoms in flowing rivers (Oesch 1995). Shallower waters (<1m) in sediments ranging from cobble and gravel in riffles with strong current to quiet water in runs with coarse gravel to sand or mud (Parmalee and Bogan 1998). Cobble and sand in moving water, rarely in ponds or lakes (Watters et.al. 2009).

Native range: The Mississippi River basin from Louisiana to Minnesota and New York. Also found in St. Lawrence River and tributaries to Great Lakes.

Nebraska collection notes: This species is represented by a single relict shell fragment collected from Logan Creek in the Elkhorn River basin and a second in Sarpy County.

Comments: My descriptions and experience with this species is with a borrowed shell from Arkansas and several relict shell found along the Mississippi River in Moline, Illinois. Rating this species as "extirpated" in Nebraska almost assumes that they were once common in the state. The collections information says this was probably never the case but they were always extremely rare. The scientific names of species are always being reviewed and, in some cases, corrected to better represent where they fit with other species. The name for the Mucket is being reviewed and may change to *Ortmanniana ligamentina.*

Mucket, *Actinonaias ligamentina*

Cross section of Mucket, 117mm, anterior end is to the left

Shell loan from Arkansas, 95mm

Shell loan from Arkansas, 95mm, dorsal view

Shell loan from Arkansas, 95mm, anterior view

Mississippi River@ Moline, Illinois, 89mm relict

Loan from Arkansas, 95mm, beak

Paper pondshell, *Utterbackia imbecillis*

Description: The Paper pondshell is a short-lived species that will get up to 100mm or so. It has an elongate and inflated shell that is very thin and delicate. The anterior end is rounded while the posterior end is bluntly pointed. The beak area is flat and may have some weak circular ridges. The interior is white. The exterior is a smooth, glossy tan, green or brown.

Similar species: It is somewhat similar to the Giant floater, Creeper and Cylindrical papershell in that they are all thin-shelled species lacking lateral or pseudocardinal teeth. However, the extreme thinness of the shell of this species as well as the flattened beak area with minimal sculpturing distinguishes this species.

Conservation status: G5, N5, S5. The Paper pondshell has been found in quite a few areas around the state, especially reservoirs where it does well.

Hosts: Black crappie, bluegill, bullfrog, channel catfish, creek chub, golden shiner, goldfish, green sunfish, largemouth bass, pumpkinseed, rock bass, spotfin shiner, tiger salamander, western mosquitofish, yellow perch.

Habitats used: Ponds, lakes and sluggish mud-bottomed pools of creeks and rivers (Cummings and Mayer 1992). Ponds and lakes. Quiet backwaters with sandy to muddy bottoms in rivers (Oesch 1995). Characteristic of impounded rivers where it inhabits the shallow bank and bay areas in mud and fine sand substrate. Ponds, borrow pits and drainage canals (Parmalee and Bogan 1998). Soft substrates in lakes, ponds, and impoundments (Watters et.al. 2009).

Distribution: Widely distributed from Texas to North Dakota and east to the Atlantic Ocean. Not found in New England or New York.

Collection notes: Relict shells are uncommon and the species has not been found in archeological digs. Lives are found across the state from border to border, most commonly in reservoirs.

Comments: The Paper pondshell has an extremely thin shell which can be easily crushed in the hand. Perhaps this might explain why it is seldom found as a relict. It does well in reservoirs and introduction via stocked fishes is a good probability. On the other hand, when a stream is impounded, they are one of the few species that will find the new habitat to its liking. It has an extensive list of host fishes but is also reported to be one of the few freshwater mussels that can reproduce without a host.

Paper pondshell, *Utterbackia imbecillis*

Cross section of Paper pondshell, 90mm, anterior end is to the right

Burchard Lake, Pawnee County, 64mm

Summit Lake, Burt County, 105mm, dorsal view

Lake Minatare, Scottsbluff County, 102mm, anterior

Lake Minatare, Scottsbluff County,

Summit Lake, Burt County, 50mm juvenile

Summit Lake, Burt County, 105mm

Holmes Lake, Lancaster County, 38mm juvenile

Lake Minatare, Scottsbluff County, 102mm, beak sculpture

Pimpleback, *Amphinaias pustulosa*

Description: The Pimpleback is a medium-sized shell (80mm) that is mostly round with a squared off posterior margin. In Nebraska the shell is moderately inflated and usually smooth though individuals with pustules have been found. They are a light yellowish tan and some, especially young ones, have a bright green stripe. There is a vague hint of a sulcus ahead of a gently rounded posterior ridge. The pseudocardinal teeth are fairly large while the lateral teeth are short and straight. The beaks are slightly raised above the dorsal margin. Beak sculpture, if any, is a couple of ridges.

Similar species: The Mapleleaf and Pimpleback are often found together and are quite similar. The Mapleleaf tends to be more squarish, has a deeper sulcus, has rows of pustules on both sides of the sulcus and is a bit more compressed. The Pimpleback is rounder, has a barely visible sulcus, is more inflated and seldom has pustules. If pustules are present, they tend to run right down the middle of the sulcus. Young Pimplebacks have a single broad green stripe down the middle of the sulcus which is sometimes visible in adults.

Conservation status: G5, N5, S2. While live Pimplebacks have been found in four watersheds, they are most common in the West Fork Big Blue River. A catastrophic event here could wipe out the single best population

Hosts: Black bullhead, brown bullhead, channel catfish, flathead catfish, shovelnose sturgeon, white crappie.

Habitats used: Medium to large rivers in mud, sand or gravel (Cummings and Mayer 1992). Small streams to large rivers on most any stream bottom except shifting sand (Oesch 1995). Large reservoirs, small to medium rivers, on gravel, sand, and silt (Parmalee and Bogan 1998). Moving water in muddy sand and cobble in large creeks and rivers (Watters et.al. 2009).

Native range: Pretty much the entire Mississippi River basin as far north as North Dakota and Minnesota.

Nebraska collection notes: Relict and dead shell are particularly common in the Big Blue River basin. Also found in the Nemaha, Lower Platte, and Elkhorn River basins. Live pimplebacks have been found in Walnut Creek (Nemaha basin), West Fork Big Blue and Lincoln Creek (Big Blue basin), and North Fork Elkhorn (Elkhorn basin). Archeologically, this species has also been found in the Republican basin.

Comments: The Pimpleback was so named because, in most of its range, the shells are covered in pimples. However, in Nebraska, Pimplebacks with pimples are rare.

Pimpleback

Amphinaias pustulosa

Cross section of Pimpleback, 62mm, anterior end on right

Big Blue River, Saline County, 74mm

Walnut Creek, Richardson County, 61mm, dorsal view

Walnut Creek, Richardson County, 61mm, anterior view

West Fork Big Blue River, Saline County, 52mm

West Fork Big Blue River, Saline County, 35mm juvenile

Walnut Creek, Richardson County, 61mm, beak sculpture

Pink heelsplitter, *Potamilus alatus*

Description: The Pink heelsplitter is a larger, oval shaped mussel with a dark brown exterior. There may be a small wing on the posterior slope which can tend to give it a triangular shape. The nacre will be pink which can vary from light to a very deep pink. The shell is fairly thin for its size but is still solid and noticeably thicker on the anterior end. The pseudocardinal teeth (two in each valve) are fairly thick and prominent. Beak sculpture is not very evident but the photo shows some faint, wide V-shaped ridges.

Similar species: The Fragile papershell is the same general shape but has a tan exterior and white nacre. The Pink papershell has a very thin shell including the anterior end. The pseudocardinal teeth of the Pink papershell are small thin ridges whereas those of the Pink heelsplitter are a larger club shape. Juvenile Pink papershells will have wings on both posterior and anterior ends. Pink heelsplitters will only have one on the posterior end.

Conservation status: G5, N5, S3. Historically widespread, they are now mainly restricted to the Missouri River. There may be some still present in Rose Creek in the Little Blue watershed.

Hosts: Freshwater drum

Habitats used: Medium to large rivers in mud or mixed mud, sand, and gravel (Cummings and Mayer 1992). Medium to large rivers in soft or coarse substrate (Seitman 2003). Most any type of substrate in slow to swiftly moving water. Sometimes adapts to the lake, river-lake type of habitat (Oesch 1995). Variety of habitats from sandy bottoms in shallow lakes and soft sandy river overbanks to coarse gravel in good current in areas up to three feet in depth (Parmalee and Bogan 1998). Lakes, impoundments, and rivers, rarely in small streams, often found in slackwater in silty sand and mud (Watters et.al. 2009).

Distribution: The Mississippi River basin from Pennsylvania to North Dakota, down to Oklahoma to Tennessee. Also Great Lakes tributaries and the Red River of the North and Winnipeg River.

Collection notes: Relict shell of this species has been found in the lower Big Blue basin, Big Nemaha River, Little Nemaha River, and Logan Creek. Live and dead shell are now found in the upper Missouri River above and below Gavins Point Dam. Dead shell in very good condition have been found in Rose Creek (Little Blue watershed).

Comments: This species has/had a limited distribution in the state.

Pink Heelsplitter, *Potamilus alatus*

Cross section of Pink heelsplitter, 147mm, anterior end is to right

Missouri River, Dixon County, 145mm

Missouri River, Dixon County, 145mm, dorsal view

Missouri River, Dixon County, 145mm, anterior view

Missouri River, Dixon County, 38mm iuvenile

Big Papillion Creek, Washington County, 102mm, beak sculpture

Pink papershell, *Potamilus ohiensis*

Description: The Pink papershell is a larger, oval shaped mussel with a dark brown exterior. There may be a small wing on the posterior slope though this is often gone. The nacre will be pink. The shell is very thin. The pseudocardinal teeth (one in each valve) are thin ridges and the lateral teeth are also very thin. There is no beak sculpture evident

Similar species: The Fragile papershell is the same general shape but has a tan exterior and white nacre. The Pink heelsplitter has a thicker shell that gets thicker still at the anterior end. The hinge teeth of the Pink papershell are small thin ridges whereas those of the Pink heelsplitter are thicker and larger. Juvenile Pink papershells will have wings on both posterior and anterior ends. Pink heelsplitters will only have one on the posterior end.

Conservation status: G5, N5, S5. The Pink papershell is quite widespread in Nebraska, perhaps because it does quite well in reservoirs and has a large variety of host fishes.

Hosts: Black crappie, common carp, gizzard shad, green sunfish, largemouth bass, longnose gar, orangespotted sunfish, sauger, white crappie.

Habitats used: Pools or sluggish streams with mud, sand, or fine gravel bottom (Cummings and Mayer 1992). Creeks to large rivers in soft or coarse substrate (Seitman 2003). Rivers that are sluggish and turbid with mud or mud-gravel bottoms (Oesch 1995). Quiet water with mud or fine sand substrate (Parmalee and Bogan 1998). Creeks, rivers and lakes with in sluggish water in sandy mud and silt (Watters et.al. 2009).

Distribution: The Mississippi River basin from Oklahoma and Tennessee north to the Great Lakes and North Dakota. Great Lakes tributaries from Erie to Superior. Manitoba and Saskatchewan in Canada.

Collection notes: This species is widespread in the eastern half of Nebraska.

Comments: This one has found reservoir habitats to its liking as it prefers quiet waters with soft bottoms and uses sunfishes as hosts. They are doing fine in streams and reservoirs. The Pink papershell and Fragile papershell are often found in the same waterbodies.

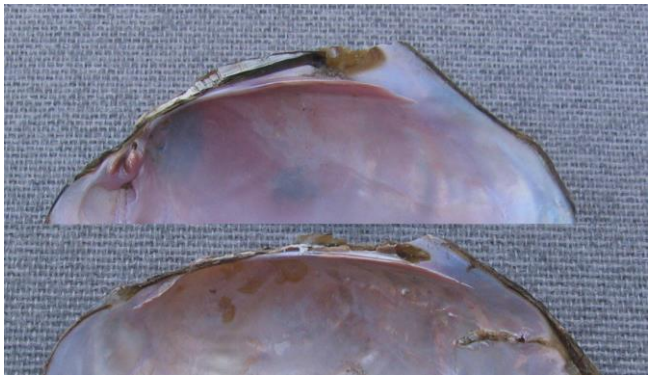
Pink papershell, *Potamilus ohiensis*

Lengthwise cross section of Pink papershell with cut edge highlighted with white paint, 136mm

Missouri River, Douglas County, 106mm

Harlan County Reservoir, Harlan County, 124mm, dorsal view

Harlan County Reservoir, Harlan County, 124mm, anterior view



Missouri River, Cedar County, upper-Pink Heelsplitter; lower-Pink Papershell, both 138mm, comparison of hinge teeth

Missouri River, Dixon County, 43mm juvenile

Sutherland Canal, Lincoln County, 123mm, beak

Pistolgrip, *Tritogonia verrucosa*

Description: The Pistolgrip is unique and the photos show why. The shell is quite thin at the extreme posterior end which steadily increases in thickness to the anterior end which is thick and heavy. The shape is a study in contrasts from the smoothly rounded anterior end grading into the posterior end with its remarkably large and prominent posterior slope, terminating in the extended "pistol-grip". The surface is covered in large tubercles.

Similar species: There are no other mussels in Nebraska that look like a Pistolgrip.

Conservation status: G5, N4/N5, S1. The Pistolgrip may still be present in the Big Blue River but its continued survival may be in doubt.

Hosts: Brown bullhead, flathead catfish, yellow bullhead.

Habitats used: Medium to large rivers in mud, sand or gravel (Cummings and Mayer 1992). May occur on any substrate, including sand (Oesch 1995). Apparently adaptable and can be found from 1 foot to 20 feet in rivers on gravel, sand, or mud (Parmalee and Bogan 1998). Large creeks with high water quality. Often found at water's edge next to current (Watters et.al. 2009).

Distribution: Widespread in North America. From Texas through the Great Plains states to South Dakota and Minnesota, east to Pennsylvania then down through Tennessee to Mississippi.

Collection notes: The Pistolgrip is fairly rare in Nebraska. Relict shell is common in the Big Blue and Big Nemaha Rivers and shell have also been found in Logan Creek. The only live one that has been found was one that I found in the Big Blue River in 2002. There are numerous archeological records from the Republican River basin and near the Missouri River in east-central Nebraska.

Comments: A single live collection in the past 100+ years of looking. The fragmentation of the Big Blue and dewatering of the Republican along with a limited number of host fishes may have hurt. They may still be present in Big Blue River but the odds of that are poor. A thorough dive survey would be needed to find out.

Pistolgrip, *Tritogonia verrucosa*

Cross section of Pistolgrip, 133mm, anterior end is on the left

Big Blue River, Gage County, 138mm

Big Blue River, Gage County, 138mm, dorsal view

Big Blue River, Gage County, 138mm, anterior view

Big Blue River, Gage County, 121mm, live

Turkey Creek, Pawnee County, 134mm, relict shell

Big Blue River, Gage County

Plain pocketbook, *Lampsilis cardium*

Description: The Plain pocketbook is a moderately large oval-shaped mussel with, when live, a tan shell with 15-20 thin green stripes radiated out from the beak. The shell is thin at the posterior end but fairly thick at the anterior end. The nacre is white. The beaks are large and curl around to meet each other. The females have a greatly inflated posterior end but the males not so much. The beak sculpture of several coarse ridges in adults is often worn away but can be seen on juveniles.

Similar species: The Higgins eye is similar to the Plain Pocketbook. The Plain Pocketbook gets larger, is generally a light tan color and has a beak sculpture of several heavy ridges. The collection of any shell suspected to be a Higgins eye should be reported.

Conservation status: G5, N5, S2. The Plain pocketbook was once widely spread. It is now restricted to the upper Elkhorn River.

Hosts: Black crappie, bluegill, green sunfish, largemouth bass, pumpkinseed, sauger, walleye, white crappie, and yellow perch as well as tiger salamander.

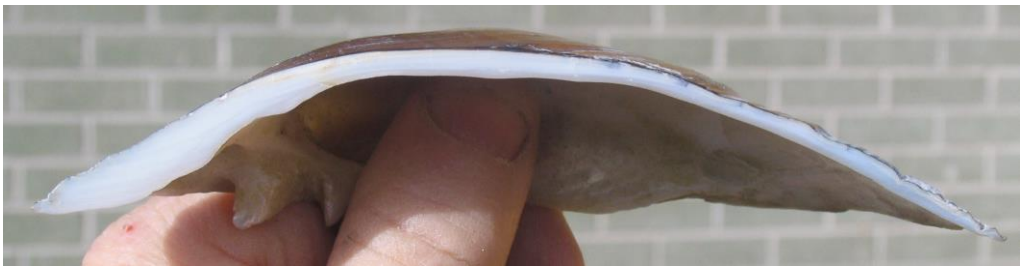
Habitats used: Small creeks to large rivers in mud, sand, or gravel (Cummings and Mayer 1992). Creeks to large rivers in soft or coarse substrate (Seitman 2003). Quiet to swift water in almost any substrate except moving sand (Oesch 1995). Medium to large rivers in moderate to strong current on coarse gravel and sand. Seems to thrive on stable substrate with high percentage of mud and silt (Parmalee and Bogan 1998). Creeks, rivers, ponds, and lakes on many substrates and water flows (Watters et.al. 2009). In Nebraska, it is found in the upper Elkhorn River on sand and shifting sand substrate as well as in Atkinson State Lake.

Native range: The Mississippi River basin from Arkansas and Tennessee north to Minnesota to New York. St. Lawrence River and Great Lakes. Canada from Saskatchewan to Ontario.

Nebraska collection notes: Shell of this species are common in the Big Blue and upper Elkhorn Rivers. They have also been found in Medicine Creek, Wood River, Loup River and Logan Creek as relict shell. The only live population is in the upper Elkhorn River.

Comments: Noting the wide variety of host fishes as well as the broad suitability of a variety of habitats, it is puzzling why the species is almost extirpated from the state. It is possible that the fragmentation by numerous power dams in the late 1900's limited the movement of their fish hosts and hurt their ability to maintain their populations. The Nebraska Game and Parks Commission is currently spawning and rearing juveniles for re-introduction into watersheds where they were historically found.

Plain pocketbook, *Lampsilis cardium*



Cross section of Plain pocketbook, 140mm, anterior end is to the left

Elkhorn River, Holt County, 130mm female

Elkhorn River, Holt County, 84mm, dorsal view

Elkhorn River, Holt County, 84mm, anterior view

Elkhorn River, Holt County, 150mm

Elkhorn River, Holt County, 76mm female juvenile

Elkhorn River, Holt County, 83mm, beak sculpture

Pondhorn, *Uniomerus tetralasmus*

Description: The shell of the Pondhorn is moderately elongate to trapezoidal and up to 120mm long. The shell is not very thick but solid. The anterior end is rounded while the posterior has a bluntly pointed end that often has a downward droop in adults. The exterior is smooth and glossy with a low rounded posterior ridge. The posterior slope will have a pair of grooves radiating from the beak to the posterior edge of the shell. Juveniles are light tan and may have faint green rays on the posterior ridge. Adults are a dark brown. There are thin lateral and pseudocardinal teeth in both valves. The beaks stand above the dorsal edge and the sculpture consists of several distinctive concentric circular ridges that radiate from a single point.

Similar species: Juveniles of the Pondhorn resemble the Creeper and the Cylindrial papershell but the presence of lateral and psuedocardinal teeth separates them. The shell shape of large Pondhorns resembles that of the Spike, *Elliptio dilatata*. The Spike usually has purple nacre and their beak sculpture is three or four coarse angular ridges.

Conservation status: G5, N5, S5. This species is fairly common in southeastern Nebraska, especially in the flood control reservoirs.

Hosts: Golden shiner

Habitats used: Ponds, small creeks, and the headwaters of larger streams in mud or sand. (Cummings and Mayer 1992). Quiet, slow-moving, shallow waters of sloughs, ponds, ditches, and meandering streams. Can survive extended periods of desiccation by burying itself deep into the substrate (Parmalee and Bogan 1998). Small creeks, small rivers, embayments of lakes. Seems to prefer prairie areas (Watters et.al. 2009).

Distribution: Found in the central Mississippi River basin. From central Louisiana to northern Indiana and Ohio to Colorado.

Collection notes: The Pondhorn is found throughout southeastern Nebraska in the Big Blue, Salt Creek, and Nemaha River basins as well as Shell Creek in the Lower Platte basin. It is also found in the Republican River basin and, rarely, the Elkhorn. There are numerous archeological records from the Republican River basin.

Comments: This species does well in small muddy creeks as well as the flood-control reservoirs in southeast Nebraska. Hosts are probably fishes commonly stocked in our flood-control reservoirs. While golden shiners are present, they aren't common enough to explain the health of the populations. The Pondhorn is unique in that it has the ability to bury itself deep into the substrate when water levels drop and can remain buried for over a year, waiting for the water to return.

Pondhorn, *Uniomerus tetralasmus*

Cross section of Pondhorn, 107mm, anterior end is to the left

Red Willow Creek, Lincoln County, 95mm

Red Willow Creek, Lincoln County, 95mm, dorsal view

Red Willow Creek, Lincoln County, 95mm. dorsal view

Lores Branch, Pawnee County, 107mm

West Fork Big Blue River, Adams County, 53mm

West Fork Big Blue River, Adams County, 19mm juvenile

West Fork Big Blue River, Adams County, 55mm, beak sculpture

Pondmussel, *Ligumia subrostrata*

Description: The Pondmussel is a small dark brown to black mussel that is less than 100 long. The posterior end terminates into a blunt point above center. The nacre is white and the hinge teeth are thin ridges. The beak sculpture is a series of closely spaced V-shaped ridges. The posterior end of the female shell is broader and more inflated, giving it a distinct trapezoidal shape on the posterior end. Hinge teeth quite thin.

Similar species: Small Black sandshells can look very similar but their hinge teeth tend to be heavier and their beak sculpture, if any, is only a few lines. The Yellow sandshell has a yellow and heavier shell. The Fatmucket is rounder on the posterior end with a yellowish-brown exterior, often with green rays.

Conservation status: G5, N5, S1. Historically, the Pondmussel was common in southeast Nebraska. The only live specimen found was a single in the upper Elkhorn River.

Hosts: Bluegill, green sunfish, orangespotted sunfish, largemouth bass.

Habitats used: Small creeks or ponds in mud or sand (Cummings and Mayer 1992). Creeks to small rivers in soft or coarse substrate (Seitman 2003). Shallow ponds, the shallow portion of lakes, sloughs, and quiet pools in rivers (Oesch 1995).). Shallow ponds, the shallow portion of lakes, sloughs, and quieter water areas in larger rivers in substrates of mud or sand (Parmalee and Bogan 1998).

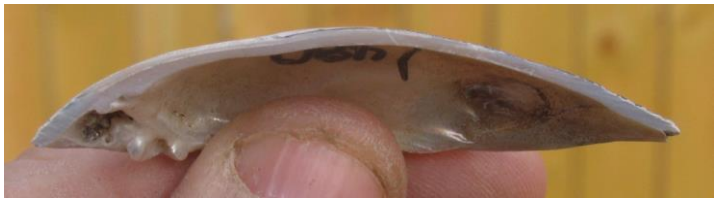
Distribution: The Mississippi River basin from Texas up through South Dakota over through Minnesota and Wisconsin into Michigan then down through Kentucky/Tennessee to Louisiana.

Collection notes: This shell of this species has most commonly been found in the Big Blue River and Nemaha River basin. It has also been found in the Little Blue River, Logan Creek, and the upper Elkhorn River though most collections have been of relict shell. Dead shell have been found in the Nemaha and Big Blue Rivers. The only live collection has been from the upper Elkhorn River. Archeologically, this has been found in Sarpy, Douglas, and Washington Counties in the Missouri Tributaries basin as well as Webster County in the Republican basin.

Comments: The collection of a live Pondmussel in the upper Elkhorn River is very odd as this is way outside the known range. If others cannot be found, we have to assume that the species may be extirpated from Nebraska.

Pondmussel

Ligumia subrostrata



Cross section of Pondmussel, 66mm, anterior end is to the

Big Blue River, Butler County, male, 68mm

Big Blue River, Butler County, 70mm, dorsal view

Big Blue River, Butler County, 70mm, anterior view

Big Blue River, Butler County, female, 62mm

Turkey Creek, Pawnee County, 19mm juvenile

West Branch Turkey Creek, Pawnee County, 38mm, beak sculpture

Rock-pocketbook, *Arcidens confragosus*

Description: [I have not seen or handled a fresh specimen so my description is based on two archeological specimens and Internet photos.] To me, the Rock pocketbook looks like a cross between a Threeridge and a Mapleleaf. It is squarish, has a sulcus next to the posterior ridge and has numerous pustules and bumps like the Mapleleaf. They can also have large posterior ribs like those of the Threeridge. The nacre is white. The exterior can be green or tan in juveniles, darkening to dark brown in adults. The beak sculpture is a series of coarse ridges which are sort of W-shaped. There are lateral and pseudocardinal teeth which are similar to but finer than those of the Mapleleaf.

Similar species: Similar in shape and size to a Mapleleaf but thinner and with distinctively different beak sculpture. Vaguely similar to a Threeridge.

Conservation status: G4, N4, SX. Their status in Nebraska is indeterminate. They were assumed to have been extirpated until the recent collection of some dead shell from the Missouri River.

Hosts: American eel, channel catfish, freshwater drum, gizzard shad, rock bass, white crappie.

Habitats used: Medium to large rivers in pools and areas of reduced flow in mud and sand (Cummings and Mayer 1992). Large rivers in soft substrates (Seitman 2003). Quiet areas of rivers in soft mud (Oesch 1995). Medium to large rivers in areas with reduced current and substrate of mud or mud and fine sand (Parmalee and Bogan 1998). Muddy sand and silt in rivers (Watters et.al. 2009).

Native range: The Mississippi River basin from Ohio to Kansas down to Texas over to Alabama and up to Minnesota

Nebraska collection notes: This species has been found as relict shell in Logan Creek in the Elkhorn River basin. Dead shell were found in 2000 in the Missouri River below Gavins Point Dam. Specimens of this species have been identified from archeological sites in Douglas and Washington counties indicating possible historical presence in the state.

Comments: I have only seen the two archeological specimens illustrated on the photo page. This species has always been extremely rare in Nebraska but there may still be a few in the Missouri River.

Rock pocketbook, *Arcidens confragosus*

Archeological site 25SY1, Sarpy County, 82mm

Archeological site 25SY1, Sarpy County, 82mm

Archeological site 25SY1, Sarpy County, 80mm

.

Archeological site 25SY1, Sarpy County, 82mm, beak sculpture

Scaleshell, *Leptodea leptodon*

Description: The Scaleshell has a small, thin, elongate shell. Less than 100mm in length, the beak is set very near the anterior end. The posterior end usually comes to a long blunt point. The shell is smooth and a greenish-tan color. Females are more rounded posteriorly and may have a wavy shell extension There is no beak sculpture.

Similar species: The Fragile papershell is the only similar species and these are oval, not elongate.

Conservation status: G1, N1/N2, S1. The status of the Scaleshell is unknown in Nebraska.

Hosts: Freshwater drum.

Habitats used: Large rivers in mud (Cummings and Mayer 1992). Medium to large rivers in soft or coarse substrate and good current (Seitman 2003). Clear, unpolluted water with good current in riffles (Oesch 1995). Sandy mud and cobble in rivers (Watters et.al. 2009).

Distribution: The Mississippi River basin from Minnesota to Tennessee and back up to New York including Great Lakes tributaries on south.

Collection notes: This species is represented by three valves collected below Gavins Point Dam. These included a single fresh-dead valve collected in the early 1980's and two valves found at RM 809.8 on 22 October 2005.

Comments: As a federally endangered species, this one would be a likely candidate for restoration efforts. However, this can hardly be considered to be a Nebraska species as we are actually beyond the western edge of its range. Getting broodstock is probably impossible and, in any case, should wait until propagation techniques are fully developed.

Scaleshell, *Leptodea leptodon*

Courtesy of Dr. Kevin Cummings, Illinois Natural History Survey

Threeridge, *Amblema plicata*

Description: The Threeridge has a medium sized shell that is oval shaped and very thick. The posterior end will have three or more rows of large, parallel, rounded ridges from the beak to the shell edge. The epidermis is dark, almost black, in adults but lighter tan in juveniles. Nacre is white.

Similar species: There are no other Nebraska species that can be confused with this one.

Conservation status: G5, N5, SNR. The map shows that the Threeridge was once common in southeast Nebraska. Live specimens have recently been found in the Missouri River below Gavins Point Dam.

Hosts: Black crappie, bluegill, channel catfish, emerald shiner, flathead catfish, freshwater drum, green sunfish, largemouth bass, northern pike, pumpkinseed, rock bass, sauger, shortnose gar, spotfin shiner, white bass, white crappie, yellow perch.

Habitats used: Small to large rivers and impoundments in mud, sand or gravel (Cummings and Mayer 1992). Creeks to large rivers in soft or coarse substrates (Seitman 2003). Primarily found on gravel or gravel-mud substrates (Oesch 1995). Small streams to large rivers as well as lakes, rivers and streams in areas with minimal to strong currents. Can be found on clay, mud, sand, sand/gravel, and gravel. Most common on sand and gravel in 0.3 to 1m depth. (Parmalee and Bogan 1998). Firm substrates in creeks, rivers, or lakes in fast or slackwater areas (Watters et.al. 2009),

Native range: The Mississippi River basin from Texas into Manitoba to NewYork. Also found in St. Lawrence River, tributaries to Great Lakes, the Red River of the North and the Gulf Coast drainages in Mississippi, Louisiana and Texas.

Nebraska collection notes: Relict and dead shell of this species is fairly common in the Nemaha River basin. It has also been found in a few locations in the Big Blue and Elkhorn River basins as relict shell. The only recently collected live or fresh dead specimens have been from the upper Missouri River below Gavins Point Dam.

Comments: That this species is doing so poorly is a mystery as it should be doing ok based on its broad range of host fishes and habitat preferences.

Threeridge, *Amblema plicata*

Cross section of Threeridge, 112mm, anterior end is to the right

Missouri River, Cedar County, 74mm

South Fork Big Nemaha River, Richardson County, 125mm, dorsal view

South Fork Big Nemaha River, Richardson County, 125mm, anterior view

Missouri River, Cedar County, 25mm juvenile

Missouri River, Cedar County, 74mm, beak sculpture

Wabash pigtoe, *Fusconaia flava*

Description: The largest Wabash pigtoe that I have found was 94mm long. The shell of the Wabash pigtoe is oblong and the posterior end tapers to a blunt point which ends below the center of the shell. The shell is thin on the posterior end but is fairly thick on the anterior end. The outside of the shell is smooth and there is a gently rounded posterior ridge between the beak and the posterior pointed end. The shell is quite compressed and the hinge teeth are well-developed. The nacre is white. The beak sculpture is usually worn away but is reported to be a few fine ridges.

Similar species: They are somewhat similar to the Creeper, but the Wabash pigtoe has well-developed hinge teeth where the Creeper does not.

Conservation status: G5, N5, S2. In spite of the S2 rating, the Wabash pigtoe is probably extirpated from Nebraska.

Hosts: Black crappie, white crappie, bluegill, creek chub.

Habitats used: Creeks to large rivers in mud, sand, or gravel (Cummings and Mayer 1992). Creeks to large rivers in soft or coarse substrates and flowing water (Seitman 2003). Gravel and sand with a moderate current (Oesch 1995). Medium to large rivers in areas with stable substrate of coarse sand, gravel, firm clay and silt (Parmalee and Bogan 1998). Nearly all substrates in fast water or lakes (Watters et.al. 2009).

Native range: The Mississippi River basin from New York to Alabama and Texas to Canada. Also St. Lawrence River and Great Lakes tributaries.

Nebraska collection notes: This species is mostly found as relict shell in the Nemaha basin or Logan Creek drainage in the Elkhorn River basin. It has also been found in the Big Blue, Salt Creek, Aowa Creek and Bow Creek drainages but always as relict shell.

Comments: This species is one of those that can exhibit dramatic change in form depending on the waterbody where it is living. Those that have been found in Nebraska represent the creek form which is quite flat and thin shelled compared to the big river form. Based on the number of relict shell found, this species was once common in the state. The heaviest populations appear to have been in the Nemaha and Logan Creek drainages, both of which have been heavily channelized. To date, no live or fresh dead Wabash pigtoes have been found.

Wabash pigtoe, *Fusconaia flava*

Cross section of Wabash pigtoe, 77mm, anterior end is to the right

Silver Creek, Otoe County, 57 to 94mm

Pony Creek, Richardson County, 59mm. dorsal view

Pony Creek, Richardson County, 59mm. anterior view

Silver Creek, Otoe County, 94mm

Pony Creek, Richardson County, 57mm, beak sculpture

White heelsplitter, *Lasmigona complanata*

Description: The White heelsplitter is a large, compressed mussel that can grow to over 200mm. The posterior end has the appearance of a blunt point that has had its tip cut off so the point is now squared off. There is usually a large wing that makes the shell look very high. It is dark brown to black and the shell is moderately thick and solid. The nacre is white and the pseudocardinal teeth are well developed. The lateral teeth of the White heelsplitter appear as a single ridge with a wavy surface which is unique to this species. The beak sculpture consists of a series of strong double loops.

Similar species: The Creek heelsplitter has a much smaller wing and it has lateral teeth similar to other mussels, one in one valve and two in the other. The Pink heelsplitter has pink nacre and normal lateral teeth.

Conservation status: G5, N5, S5. The White heelsplitter is one species that is doing well in Nebraska.

Hosts: Black crappie, common carp, gizzard shad, green sunfish, largemouth bass, longnose gar, orangespotted sunfish, sauger, white crappie.

Habitats used: Pools or sluggish streams with mud, sand, or fine gravel bottom (Cummings and Mayer 1992). Creeks to large rivers in soft or coarse substrate (Seitman 2003). Rivers that are sluggish and turbid with mud or mud-gravel bottoms (Oesch 1995). Quiet water with mud or fine sand substrate (Parmalee and Bogan 1998). Creeks, rivers and lakes with in sluggish water in sandy mud and silt (Watters et.al. 2009).

Distribution: The Mississippi River basin from Oklahoma and Tennessee north to the Great Lakes and North Dakota. Great Lakes tributaries from Erie to Superior. Manitoba and Saskatchewan in Canada.

Collection notes: This species is widespread in the southeastern half of Nebraska.

Comments: Their current range nicely overlaps the historic range shown by archeological collections. The White heelsplitter has found reservoir habitats to its liking as it prefers quiet waters with soft bottoms and can use sunfishes as hosts. They are doing fine in streams and reservoirs.

White heelsplitter, *Lasmigona complanata*

Cross section of White heelsplitter, 146mm, anterior end is to the right

Johnson Lake, Gosper County, 147mm

Mission Creek, Gage County, 160mm, dorsal view

Johnson Lake, Gosper County, 147mm, anterior end view

Johnson Lake, Gosper County, 147mm, lateral teeth

Mud Creek, Custer County, 60mm

Missouri River, Dixon County, 27mm

Pony Creek, Richardson County, 103mm, beak sculpture

Yellow sandshell, *Lampsilis teres*

Description: The Yellow sandshell has a long oval shell that is moderately thick and stout. The periostracum is a glossy yellow to dirty yellow/tan often with green rays which may be hard to see in larger adults. The posterior end of males extends into a long blunt point. The posterior end of females is expanded and a trapezoidal shape. The nacre is white which may have a pink tint. I have found two forms of beak sculpture as discussed below under Comments.

Similar species: The Fatmucket is more oval shaped and the posterior end is more bluntly rounded, especially in females. The Pondmussel is smaller with a shorter, thinner shell and a dark periostracum.

Hosts: Black crappie, bluegill, green sunfish, largemouth bass, longnose gar, orangespotted sunfish, shortnose gar, shovelnose sturgeon, white crappie, yellow perch.

Conservation status: G5, N5, S3. Live Yellow sandshells have been collected from several streams but I wouldn't say they are doing well.

Habitats used: Medium to large rivers in fine sand or gravel (Cummings and Mayer 1992). Large rivers in soft or coarse substrate (Seitman 2003). Rivers that are large, warm, and turbid (Oesch 1995). One form is found in quiet water and sandy-muddy bottom while a second form is found in strong current and gravel (Parmalee and Bogan 1998). Found in sandy mud in large rivers, it rarely strays into smaller streams (Watters et.al. 2009).

Distribution: The Mississippi River basin to Minnesota. Rio Grande and Red River in Texas and Mexico. Gulf Coast drainage from Louisiana to Florida. Great Lakes tributaries in U.S.

Collection notes: This species has been found in the Big Blue River (relict, dead), Nemaha Basin (relict, dead, live), Logan Creek (relict, live), Salt Creek (dead, live) and upper Missouri River below Gavins Point Dam (dead, live).

Comments: There are supposed to be two "forms" of this species (the Yellow Sandshell and the Slough Sandshell) that are found in contrasting habitats (fast water/gravel and slow water/silt-mud). We may have both forms shown by the two types of beak sculpture that are illustrated. The one with the V-shaped ridges (Rock Creek, Saunders County) fits the descriptions of the Slough Sandshell. This is the form most commonly seen in the state. The other one with almost no beak sculpture (Missouri River, Douglas County) fits descriptions of the Yellow Sandshell. Both forms are now considered to be the same species. The recent collections combined with archeological finds show that this was once a widespread species in the state.

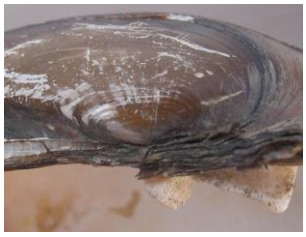
Yellow sandshell, *Lampsilis teres*

Cross section of Yellow sandshell, 100mm, anterior end is to right

Salt Creek, Lancaster County, female, 100mm

Salt Creek, Lancaster County, 100mm, dorsal view

Salt Creek, Lancaster County, 100mm, anterior



Missouri River, Douglas County, 120mm. beak sculpture

Rock Creek, Saunders County, juveniles upper: male, 63mm, lower: female, 61mm

Rock Creek, Saunders County, 80mm, beak sculpture

Fingernail clams, *Sphaerium, Musculium, Pisidium sp.*

Description: Fingernail clams are tiny clams found throughout Nebraska. There are a number of species some of which can get up to 15-20mm whereas others never get larger than 4mm. As the name implies, the largest ones are smaller than your fingernail. Their shells are thin and have true cardinal teeth that are flanked by lateral teeth on both sides (but you will need a microscope to see them). Shells can be glossy or dull. Nacre is always white or off-white though some are so thin that you can almost see through them.

Similar species: Asian clams have a thick, heavy shell with coarse concentric ridges.

Conservation status: None. We don't track the status of Fingernail clams.

Hosts: None. This species can reproduce without a host.

Habitat: They are found in all types of habitat from silty quiet streams to fast water as well as ponds and lakes. Some species can be found in ephemeral ponds (ponds that often dry up).

Distribution: Worldwide

Collection notes: I have found Fingernail clams all across the state. To date, I have tentatively identified eleven species.

Comments: Fingernail clams are true clams in that they do not need a fish host to reproduce. Eggs are fertilized internally and the young grow within the shells of the adults, to be released when they are self-supporting. They filter minute food items out of the water and, in turn, are food for many organisms.

Fingernail clams

Sphaerium simile, 8mm

Sphaerium simile, 12mm, inside view

Pisidium sp., less than 5mm

Musculium transversum, 14mm

Musculium securis, less than 6mm

Asian clam, *Corbicula fluminea*

Description: The Asian clam is a small mussel with a triangular shaped shell. The largest that I have seen was 48mm thought they are usually half that size. It has a glossy periostracum with numerous coarse ridges in concentric rings around the shell. The shell is thick. Pinching the shell hard between the fingers, you cannot crush it as you can a native fingernail clam's shell. This species has cardinal teeth at the beak position and two sets of lateral teeth, one on each side of the cardinal teeth. The nacre is white with faint purple bands.

Similar species: Very small individuals are somewhat similar to native fingernail clams but the presence of a glossy periostracum and coarse ridges around the shell distinguish this. Their shell is also much thicker than that of a fingernail clam.

Conservation status: None. This is an exotic invasive species in Nebraska.

Hosts: None. This species can reproduce without a host.

Habitat: The Asian clam doesn't seem to be too particular as it can live in freshwater or brackish water. It generally prefers sandy or gravelly substrates but can live in silty lakes. They do better in flowing water because these will provide a better food supply.

Distribution: Now found throughout the U.S. with the possible exception of North Dakota and Montana.

Collection notes: They were first collected from a Salt Valley lake in 1991 by Keith Perkins. They have since expanded their range to include the entire Platte River and Missouri River systems.

Comments: The Asian clam does not have parasitic larvae and can reproduce without the need for a host fish. They are also hermaphroditic so it only takes one to start a new population.

Asian clam, *Corbicula fluminea*

Yankee Hill Reservoir, Lancaster County, 40mm

Yankee Hill Reservoir, Lancaster County, 40mm, dorsal view

Yankee Hill Reservoir, Lancaster County, 40mm, anterior view

Yankee Hill Reservoir, Lancaster County, 40mm, view of hinge teeth

Yankee Hill Reservoir, Lancaster County, 10mm juvenile

Comparison of Asian clam (top left), Zebra mussel (lower left) with fingernail clam (lower right) with coin for size reference.

Zebra mussel, *Dreissena polymorpha*

Description: The Zebra mussel is a small, thin-shelled mussel that rarely gets over 35-40mm. The shell is smooth and often has a pattern of light and dark bars suggestive of a zebra's stripes. One site of the shell is flat and the other side is curved giving it a D-shaped appearance. Zebra mussels extrude a tough fiber called a byssal thread that it used to attach itself to any hard surface.

Similar species: There are no freshwater mussels that look like a Zebra mussel.

Conservation status: None. This is an exotic invasive species in Nebraska.

Hosts: None. This species can reproduce without a host.

Habitat: The Zebra mussel doesn't seem to be too particular as it can live in freshwater or brackish water. They attach themselves to hard surfaces so areas with rocks, pilings, boat docks and boats can be heavily infested. They do better in flowing water because these will provide a better food supply.

Distribution: They are now found though much of the Mississippi River basin east of Nebraska, the Great Lakes watershed, the St. Lawrence River and Hudson River.

Collection notes: The first live Zebra mussels found in Nebraska were in the Offutt Base Lake in Bellevue in 2006. A few years later, they were found in Zorinsky Reservoir in Douglas County. In 2015, they were found at several locations in Lewis and Clark Lake.

Comments: The Zebra mussel does not have parasitic larvae and can reproduce without the need for a host fish. There were attempts to eradicate the populations in Offutt Base Lake and Zorinsky Reservoir. As of this writing, the eradication effort in Offutt Base Lake was a failure but the Zorinsky Reservoir attempt apparently was successful. In 2015, live populations were found in Lewis and Clark Lake above Gavins Point Dam. Since then, they have been found in the Missouri River below Gavins Point Dam. It is to be expected that these populations will continue to expand.

Zebra mussel, *Dreissena polymorpha*

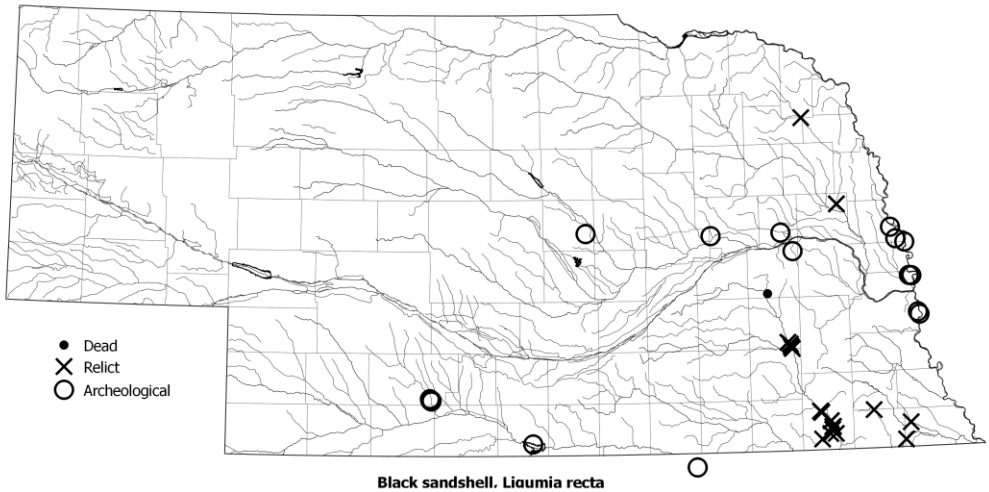
Zorinsky Reservoir, Douglas County, 30mm

Zorinsky Reservoir, Douglas County, 30mm. dorsal view

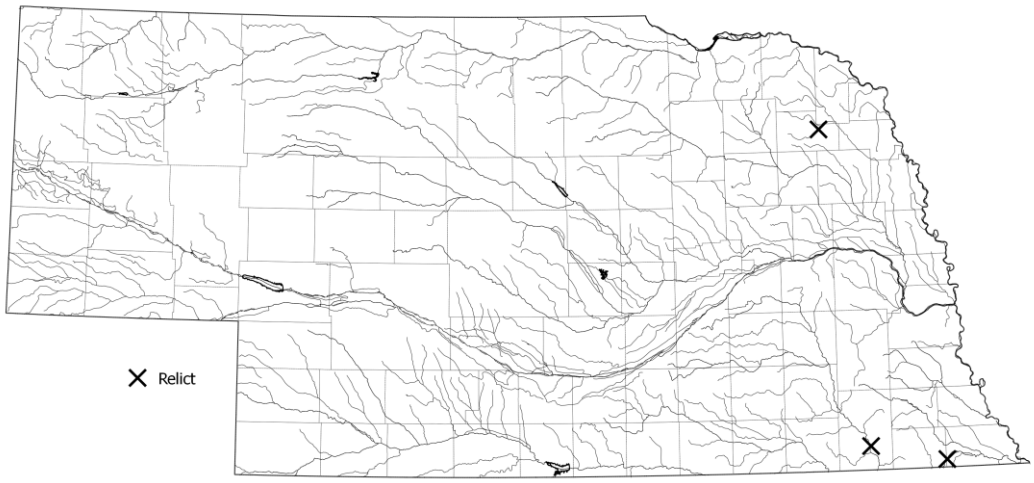
Zorinsky Reservoir, Douglas County, 30mm. ventral view

Zorinsky Reservoir, Douglas County, 30mm, anterior view

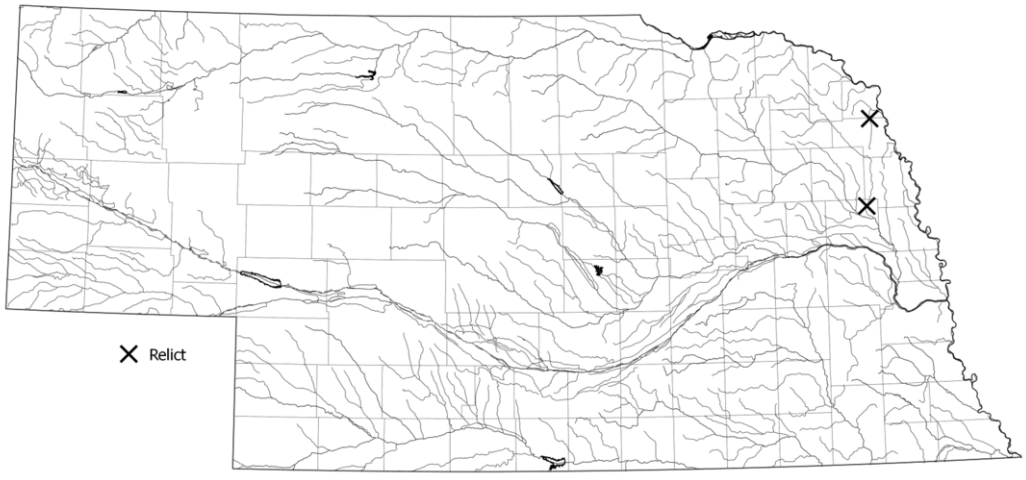
Maps



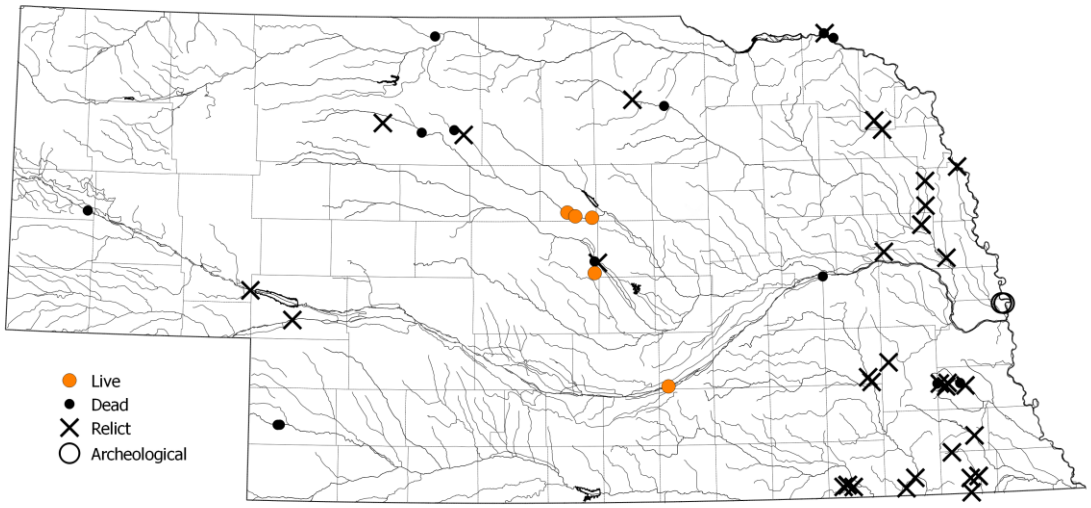
Black sandshell, Ligumia recta



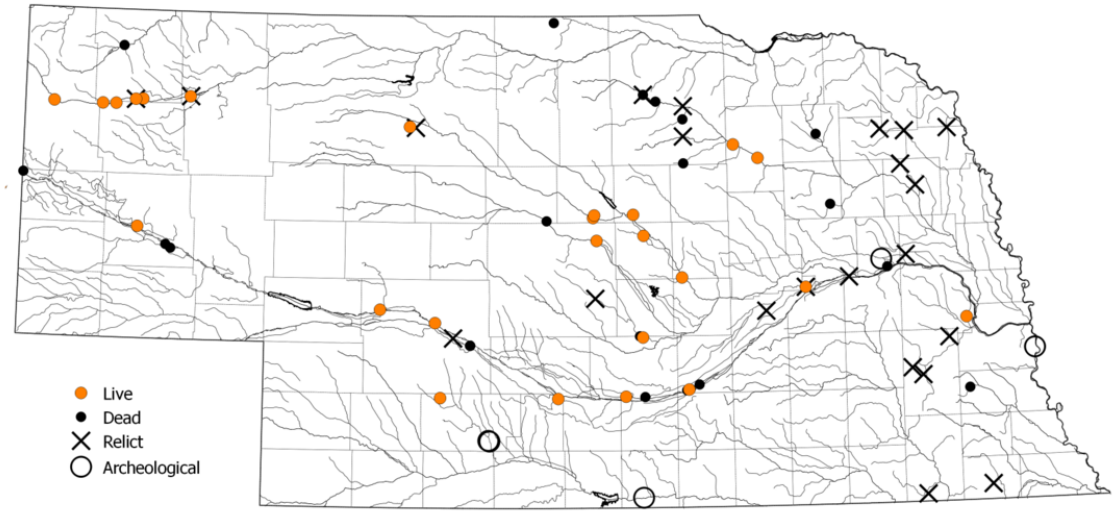
Bleufer, Potamilus purpuratus



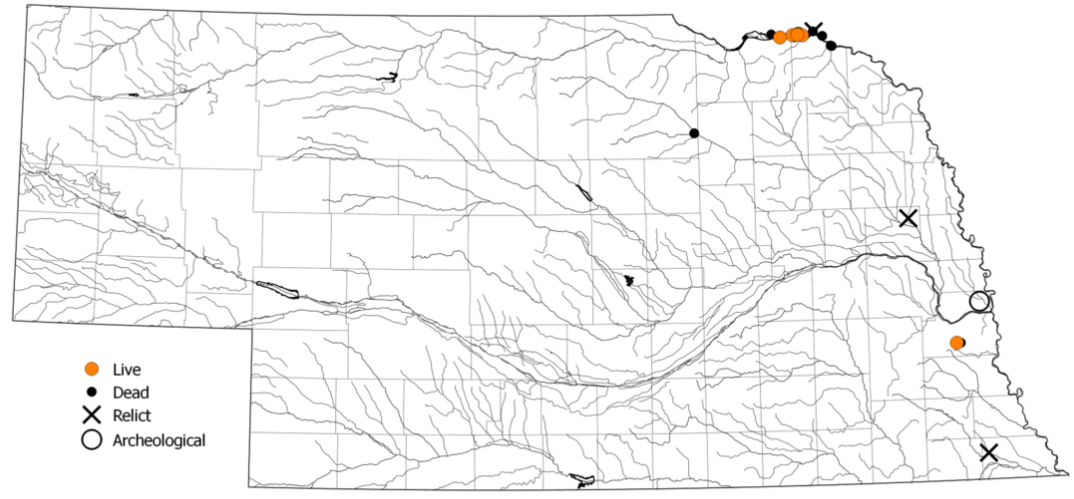
Creek heelsplitter, Lasmigona compressa



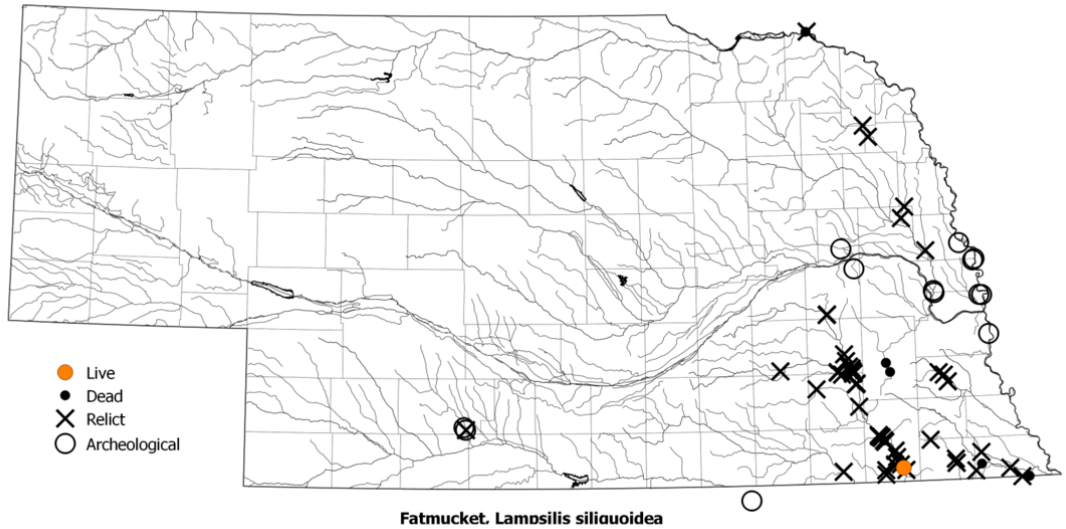
Creeper, Strophitus undulatus



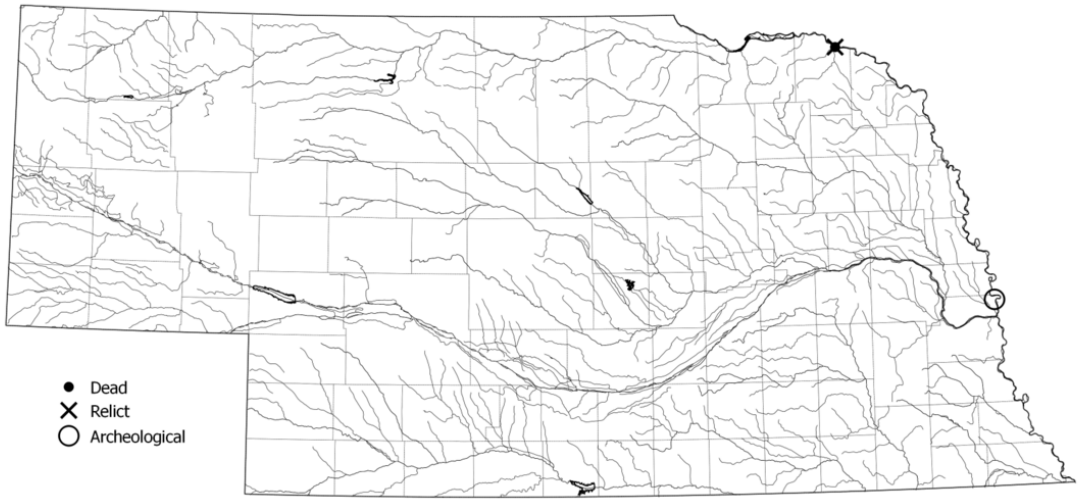
Cylindrical papershell, Anodontoides ferussacianus



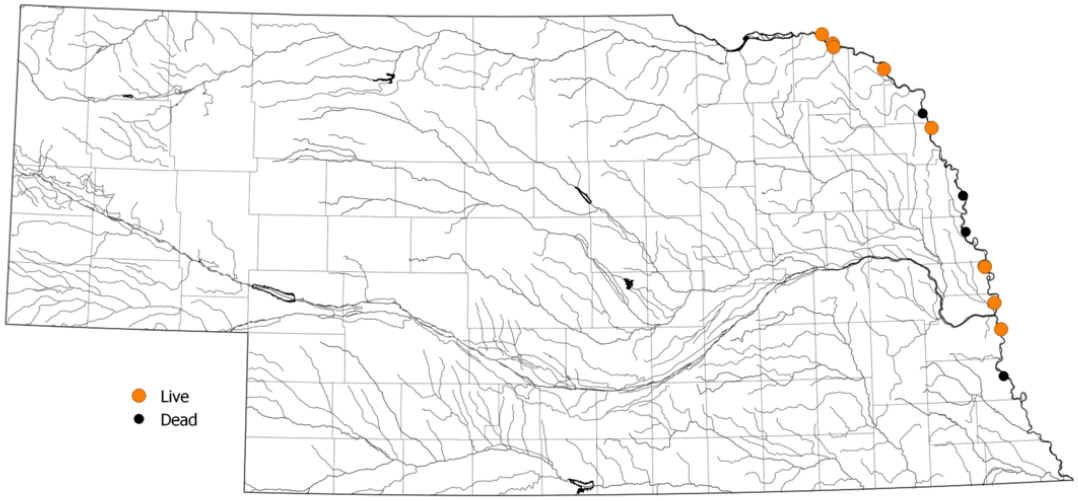
Deertoe, Truncilla truncata



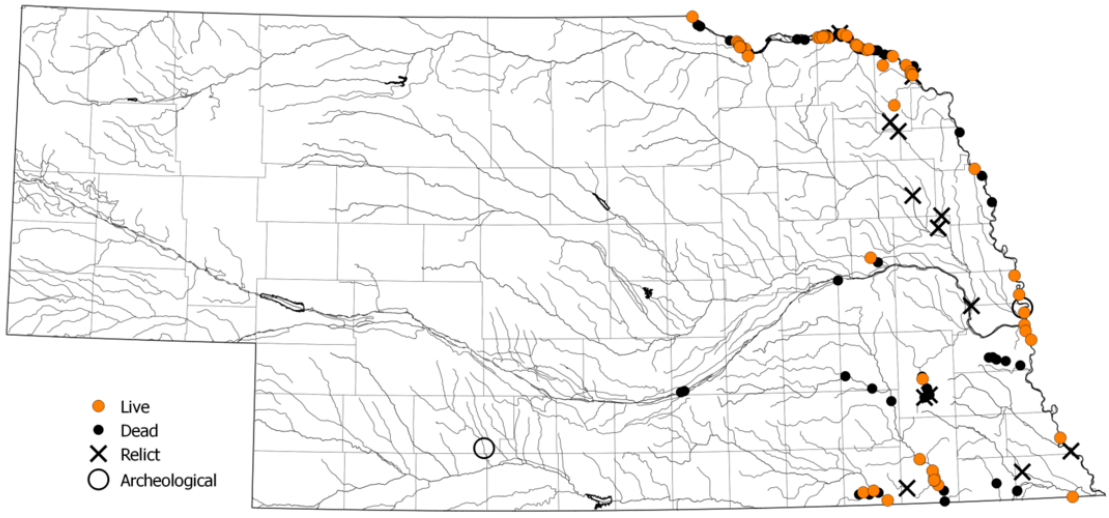
Fatmucket, Lampsilis siliquoidea



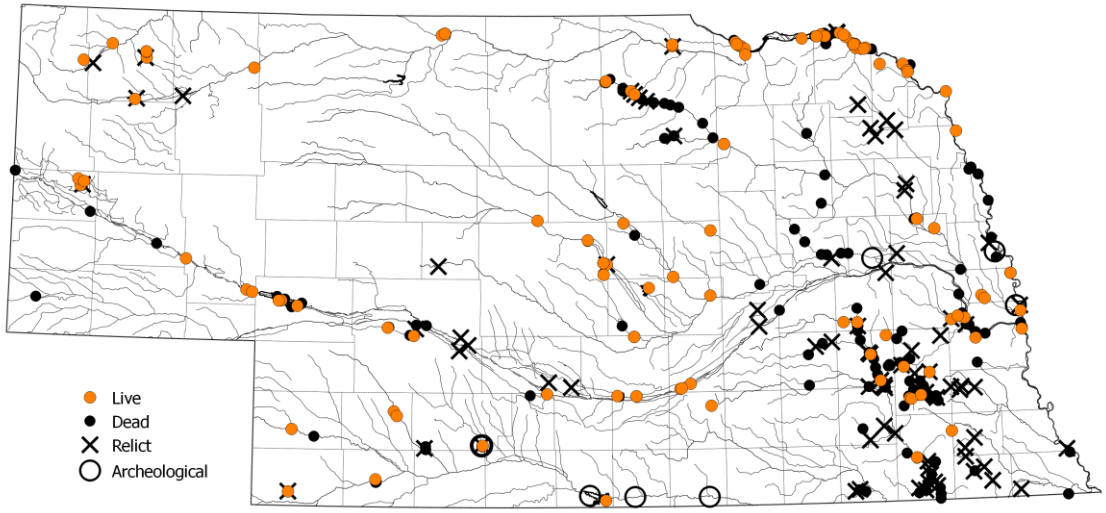
Fawnsfoot, Truncilla donaciformis



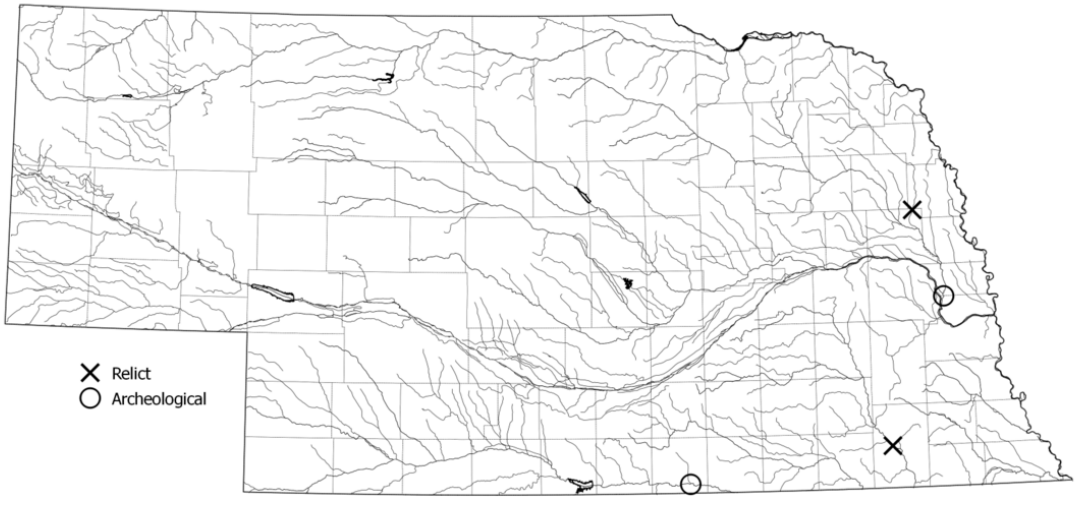
Flat floater, Utterbackia suborbiculata



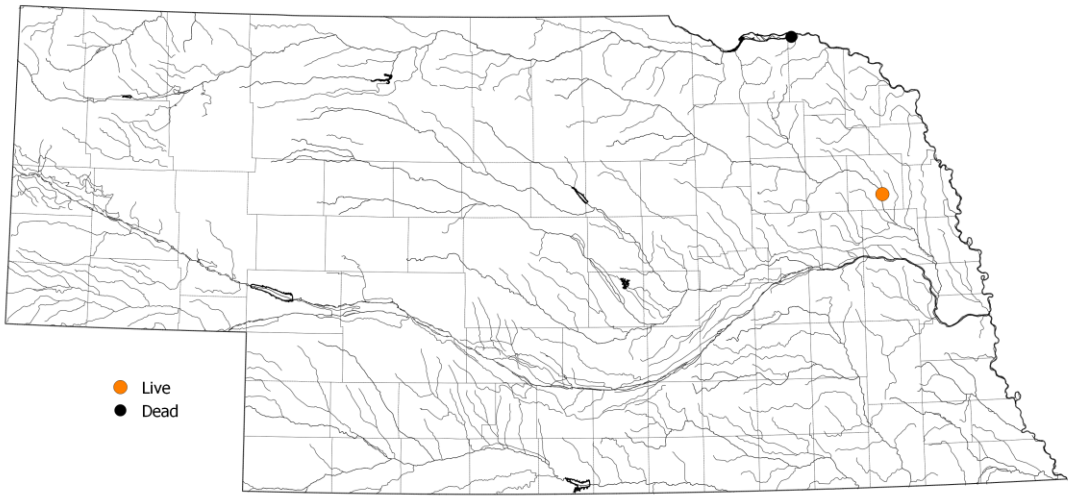
Fragile papershell, Leptodea fragilis



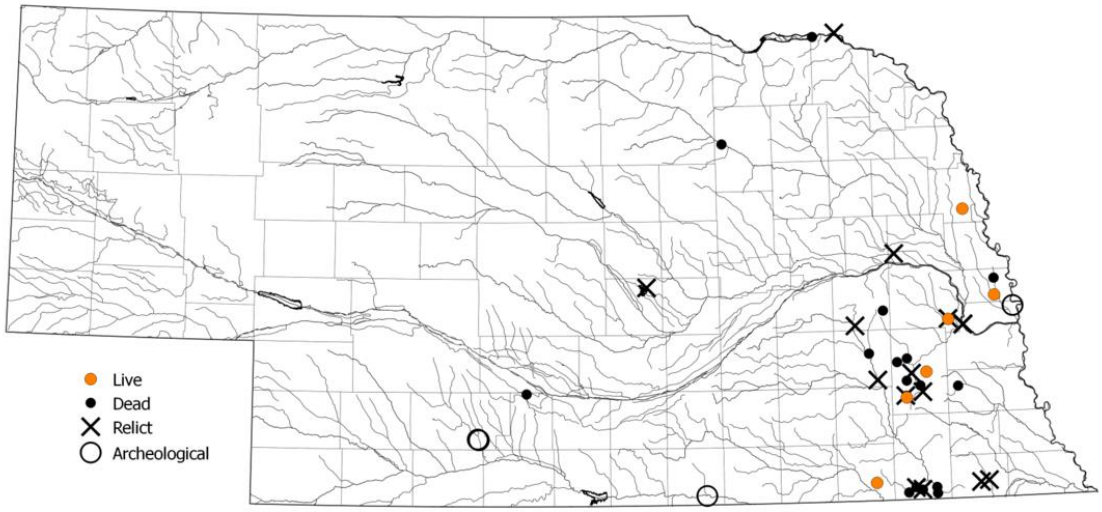
Giant floater, Pyganodon grandis



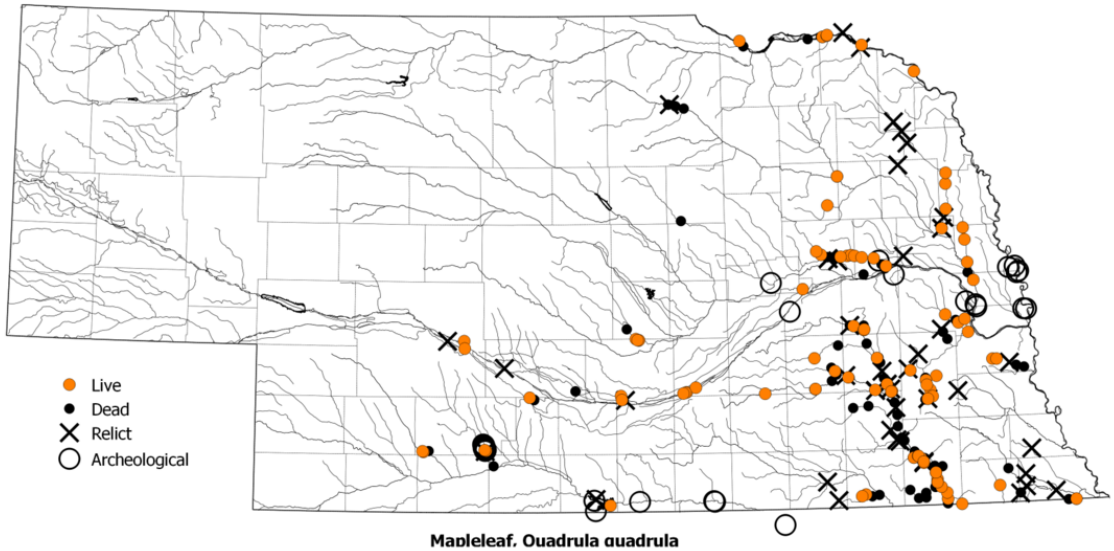
Hickorynut, Obovaria olivaria



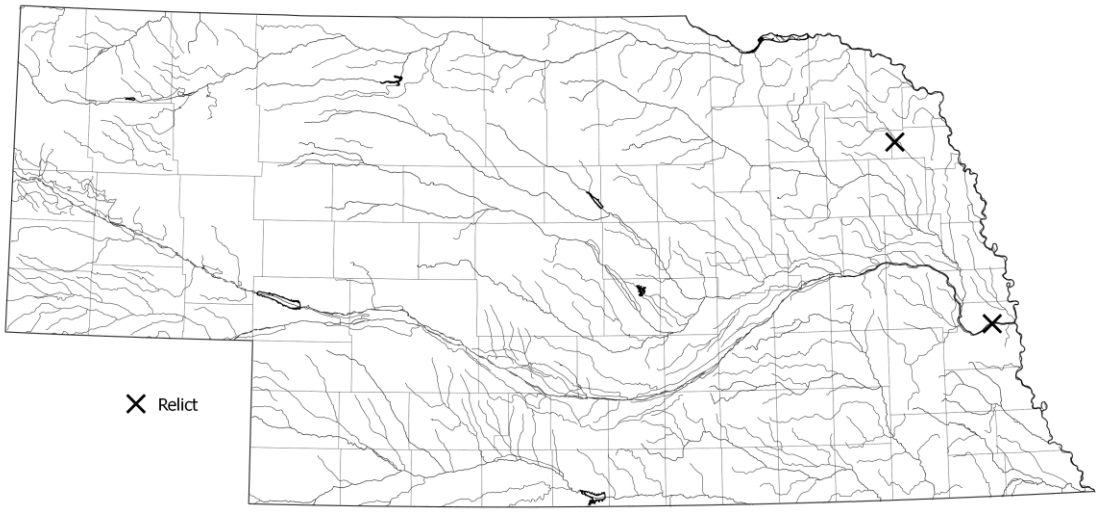
Higgins eye, Lampsilis higginsii



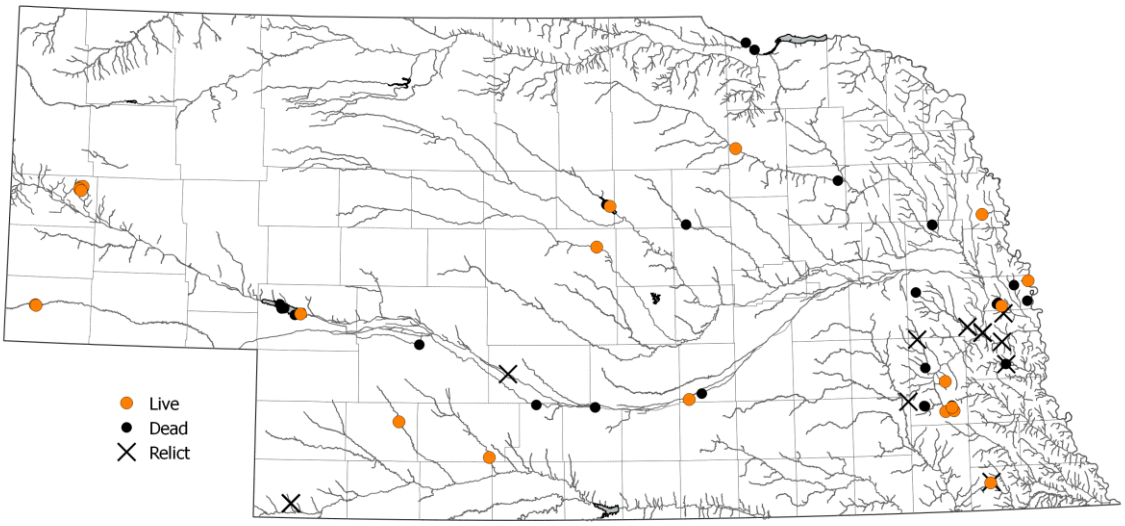
Lilliput, Toxolasma parvum



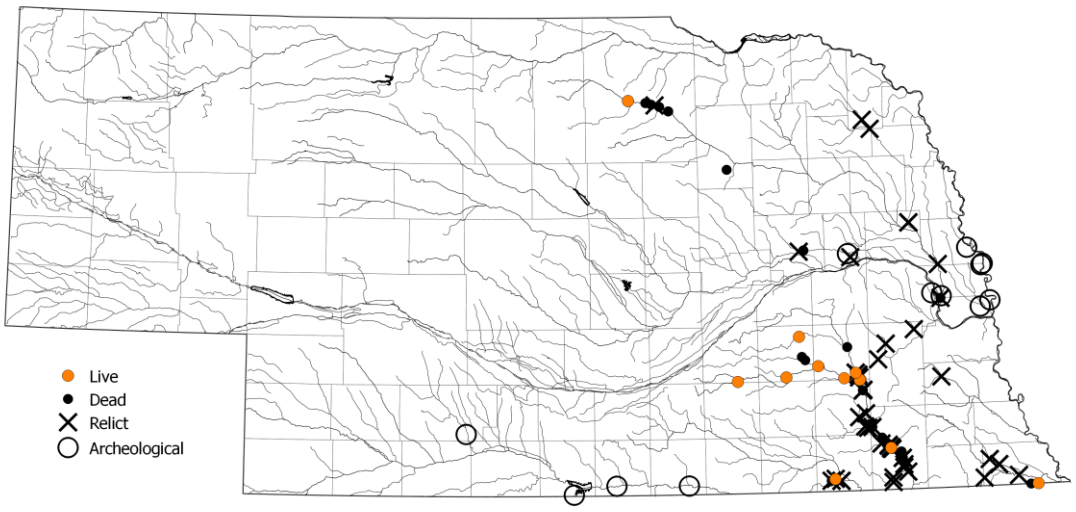
Mapleleaf, Quadrula quadrula



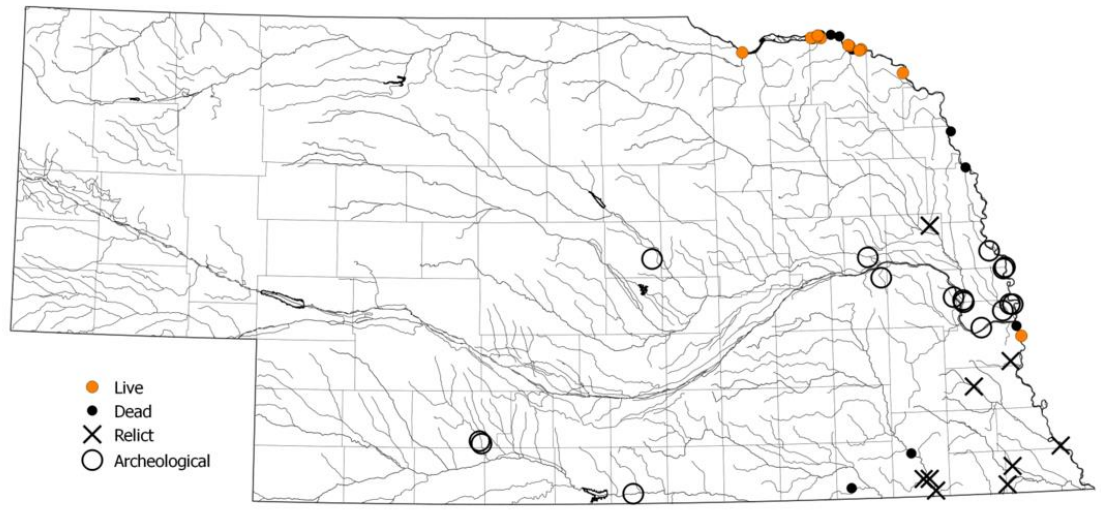
Mucket, Actinonaias ligamentina



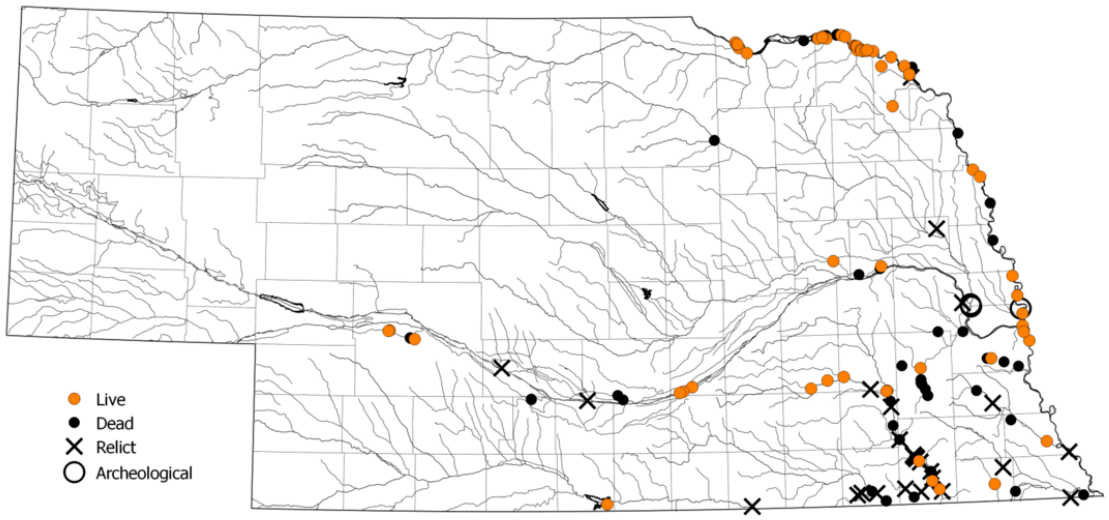
Paper pondshell, Utterbackia imbecillis



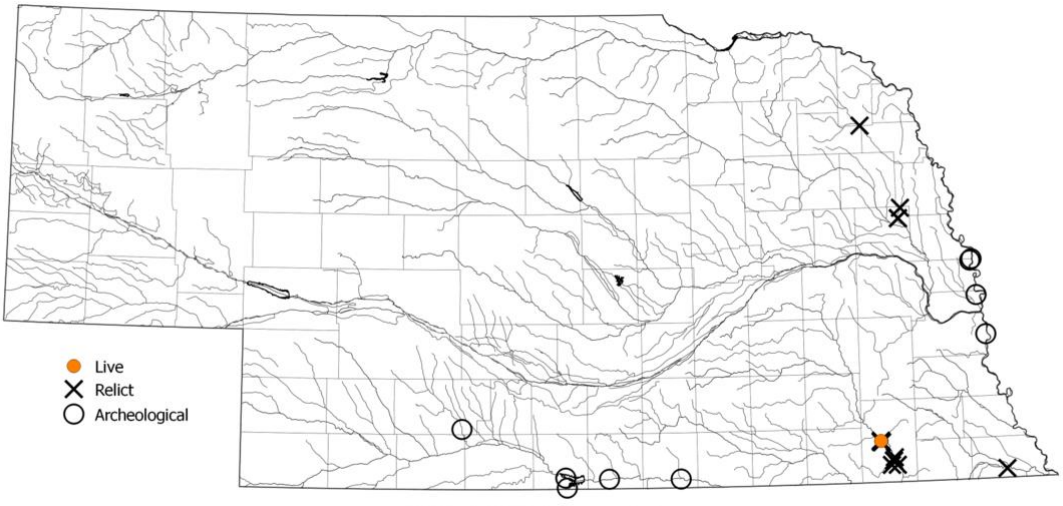
Pimpleback, Amphinaias pustulosa



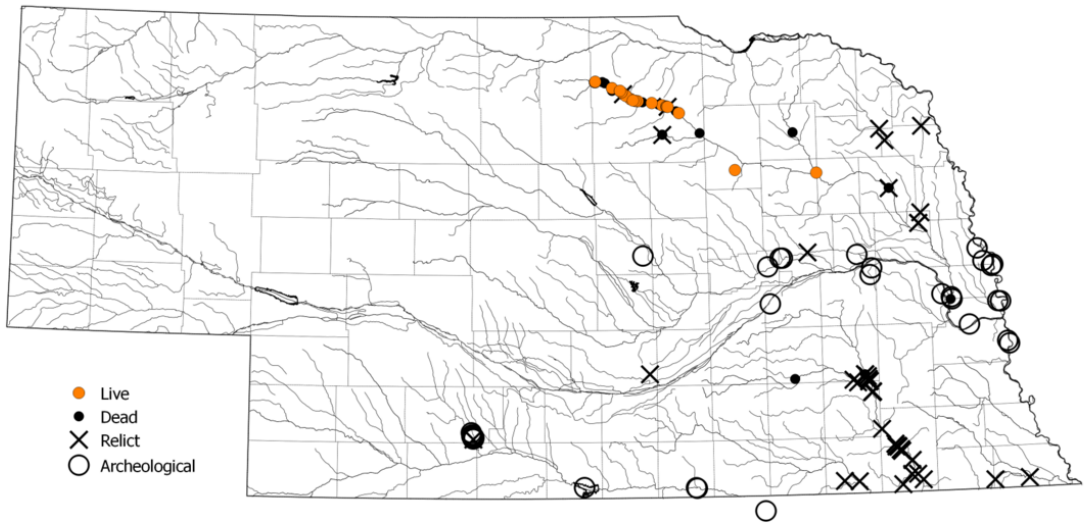
Pink heelsplitter, Potamilus alatus



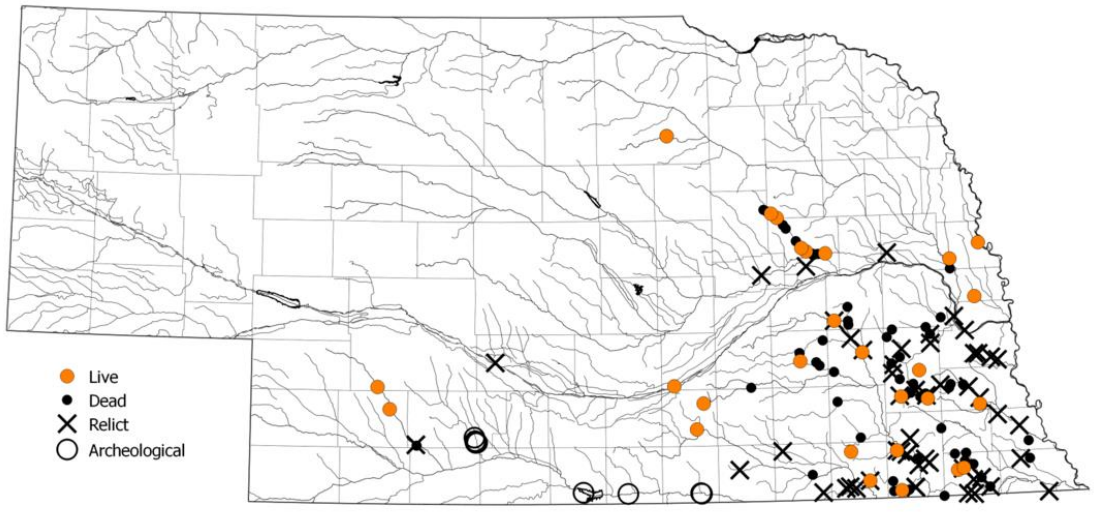
Pink papershell, Potamilus ohiensis



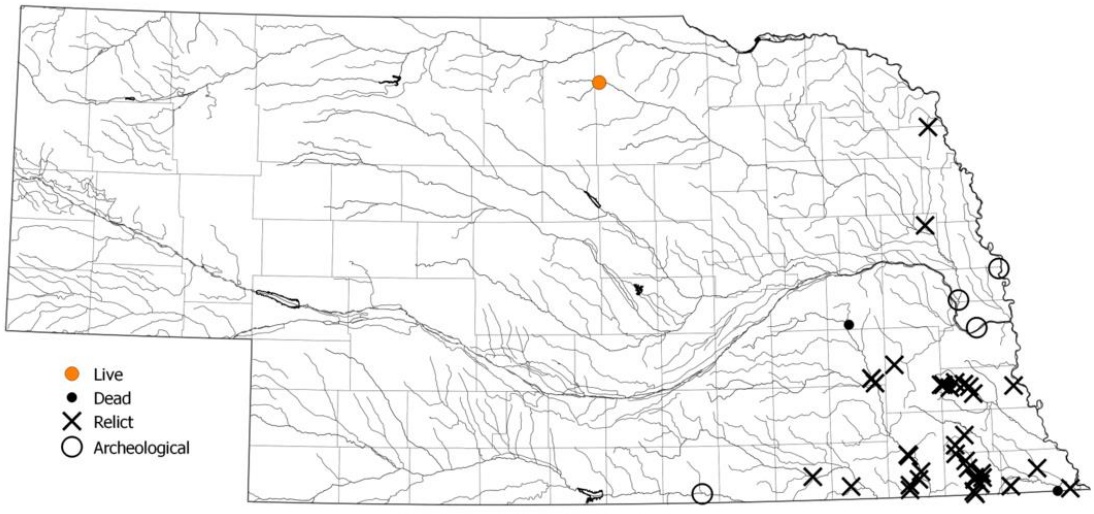
Pistolgrip, Tritogonia verrucosa



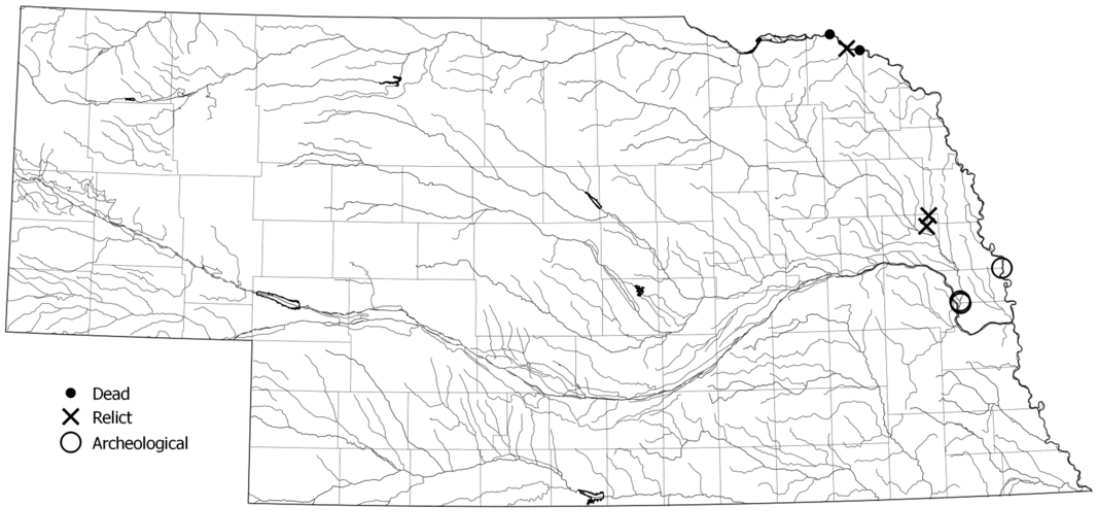
Plain pocketbook, Lampsilis cardium



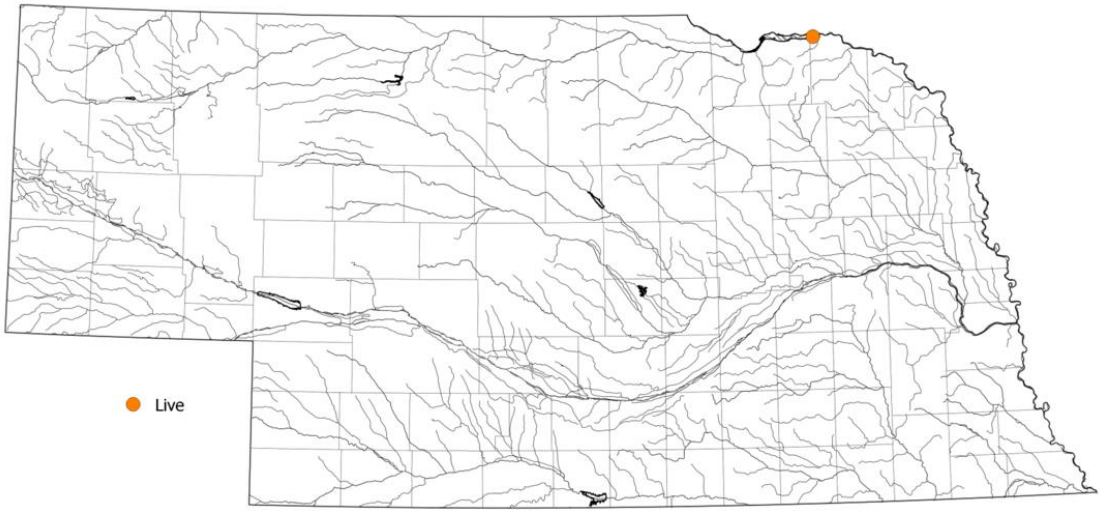
Pondhorn, Uniomerus tetralasmus



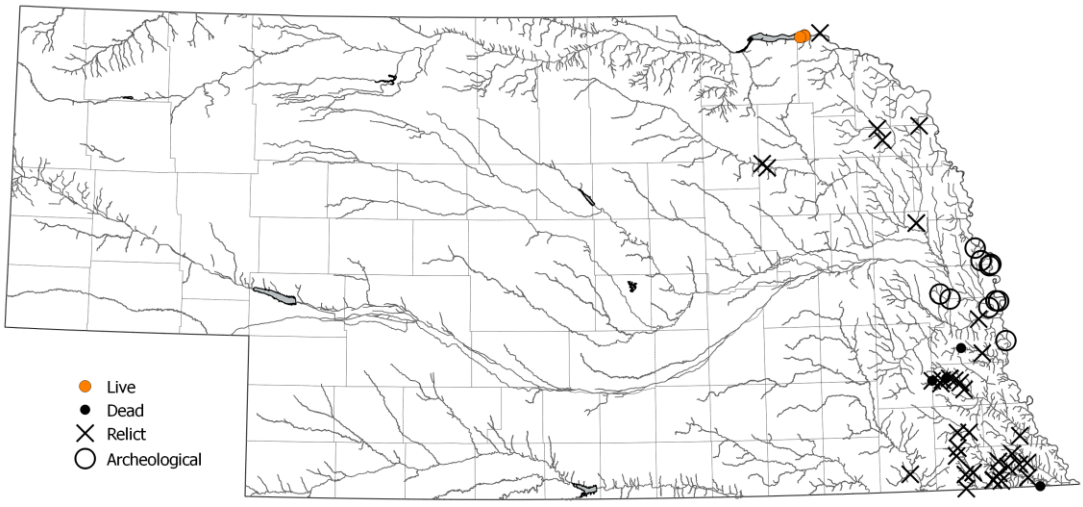
Pondmussel, Ligumia subrostrata



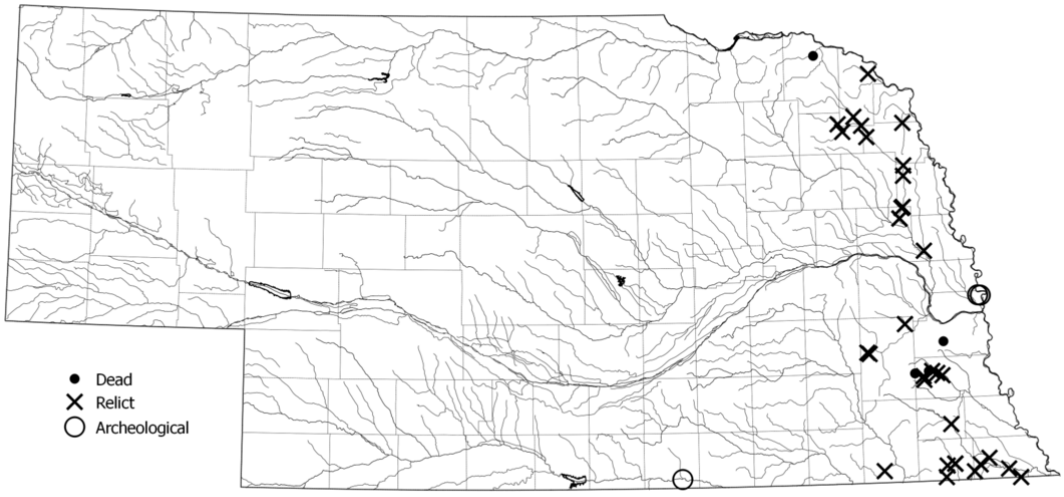
Rock-pocketbook, Arcidens confragosus



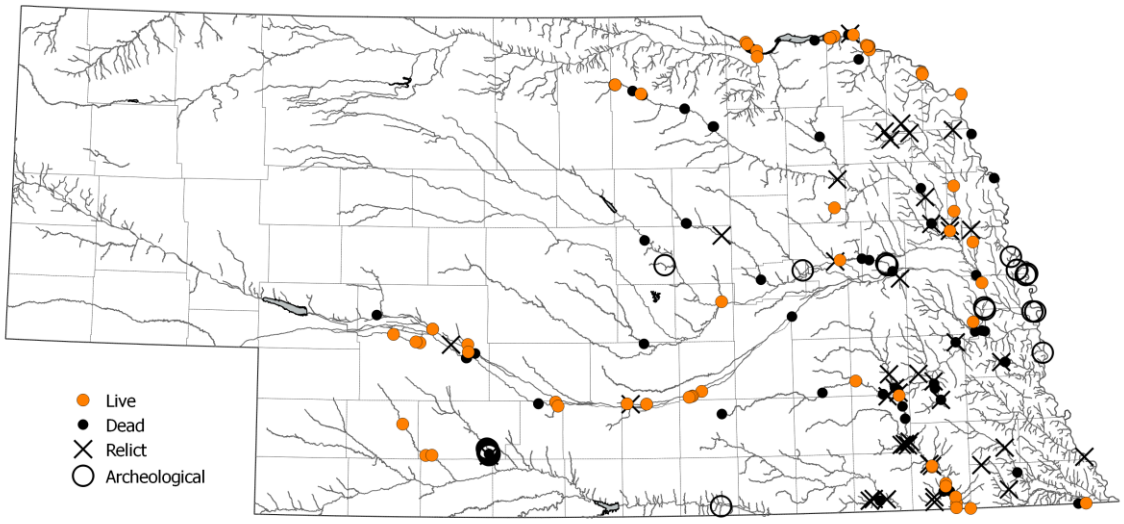
Scaleshell, Leptodea leptodon



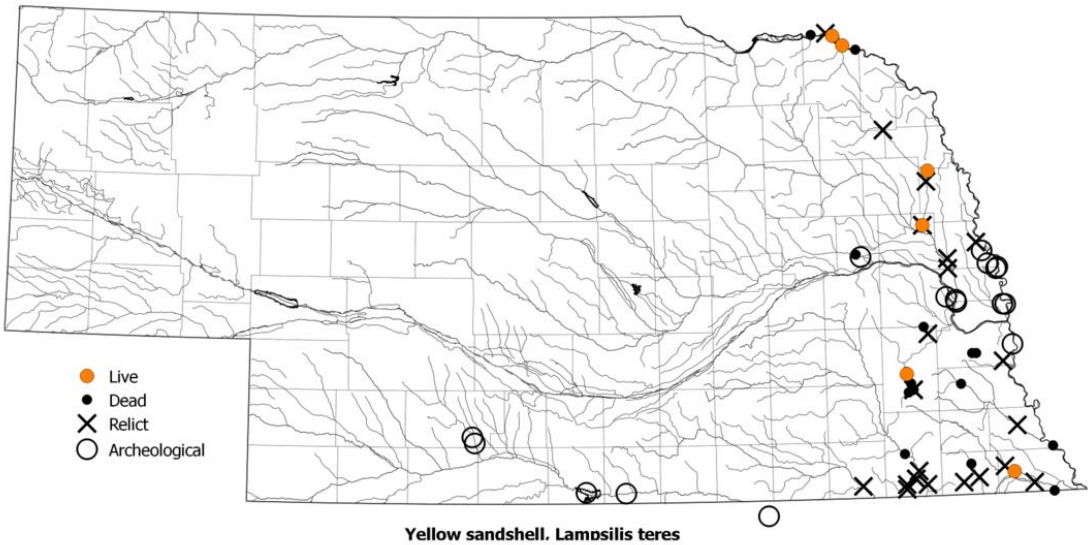
Threeridge, Amblema plicata



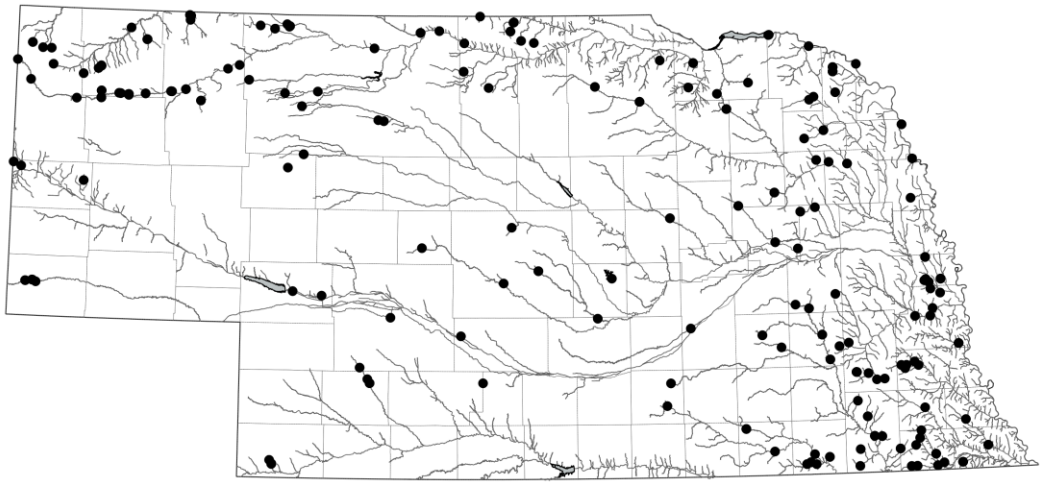
Wabash pigtoe, Fusconaia flava



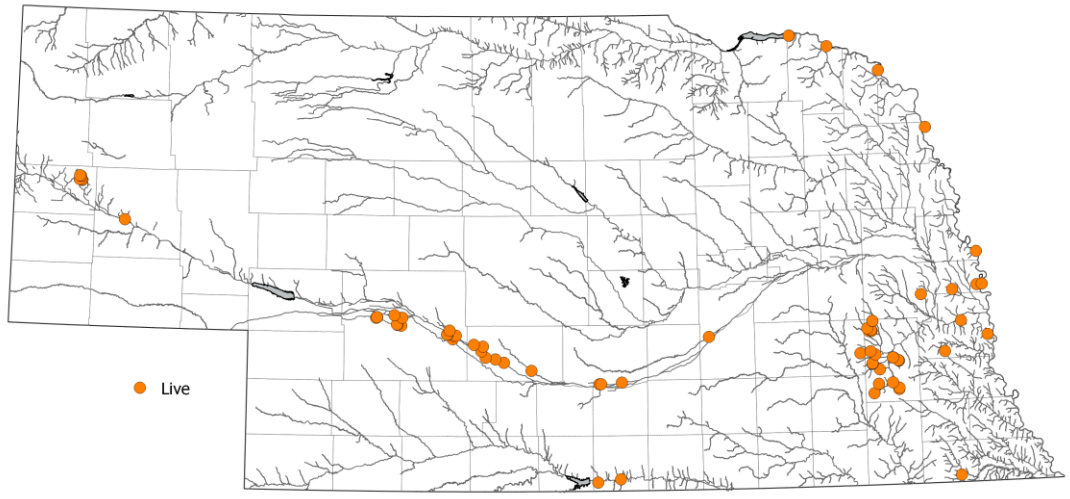
White heelsplitter, Lasmigona complanata



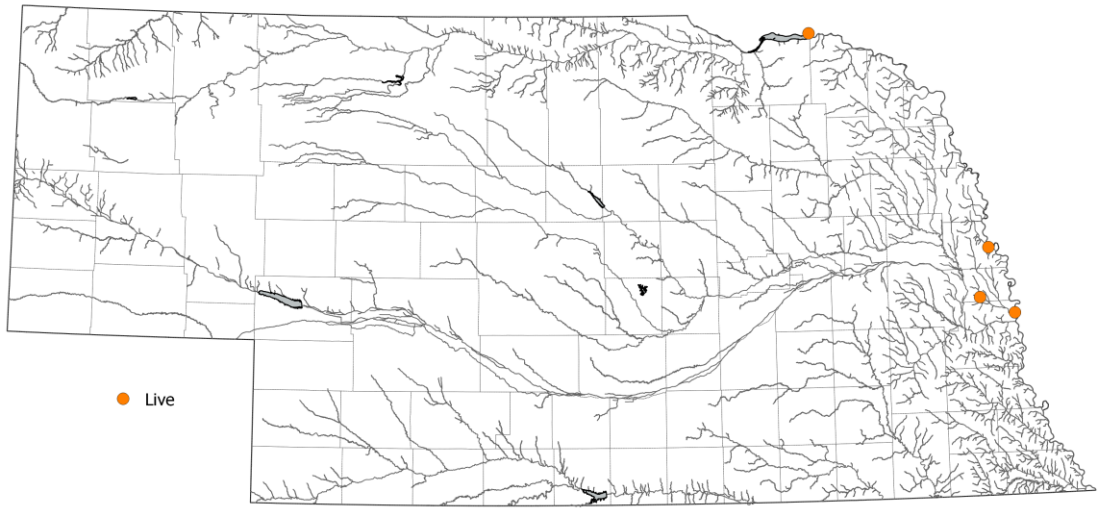
Yellow sandshell, Lampsilis teres



Fingernail clam collection sites



Asian clam, Corbicula fluminea



Zebra mussel, Dreissena polymorpha

Suggested Guides to Freshwater Mussels

Cummings, K.S. and C.A. Mayer. 1992. Field guide to the freshwater mussels of the Midwest. Illinois Natural History Survey Manual No. 5.

Oesch, R.D. 1995. Missouri naiades, a guide to the mussels of Missouri. Missouri Department of Conservation, Columbia.

Parmalee, P.W. and A.E. Bogan. 1998. The freshwater mussels of Tennessee. The University of Tennessee Press, Knoxville.

Seitman, B.E. 2003. Field guide to the freshwater mussels of Minnesota. Minnesota Department of Natural Resources, St.Paul.

Watters, G.T., M.A. Hoggarth, and D.H. Stansbery. 2009. The freshwater mussels of Ohio. The Ohio State University Press, Columbus, Ohio, USA.

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3. Ball, G. H. 1922. Variation in fresh-water mussels. Ecology III(2): 93-121.

4. Baxa, Mark. 1981. *Anodonta* species of Lake McConaughy, western Nebraska. The Nautilus 95(4): 180-183.

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Keith Perkins. 1992. Survey of mollusks of the Platte River. Final report for the U.S.Fish and Wildlife Service, Grand Island, Nebraska.

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